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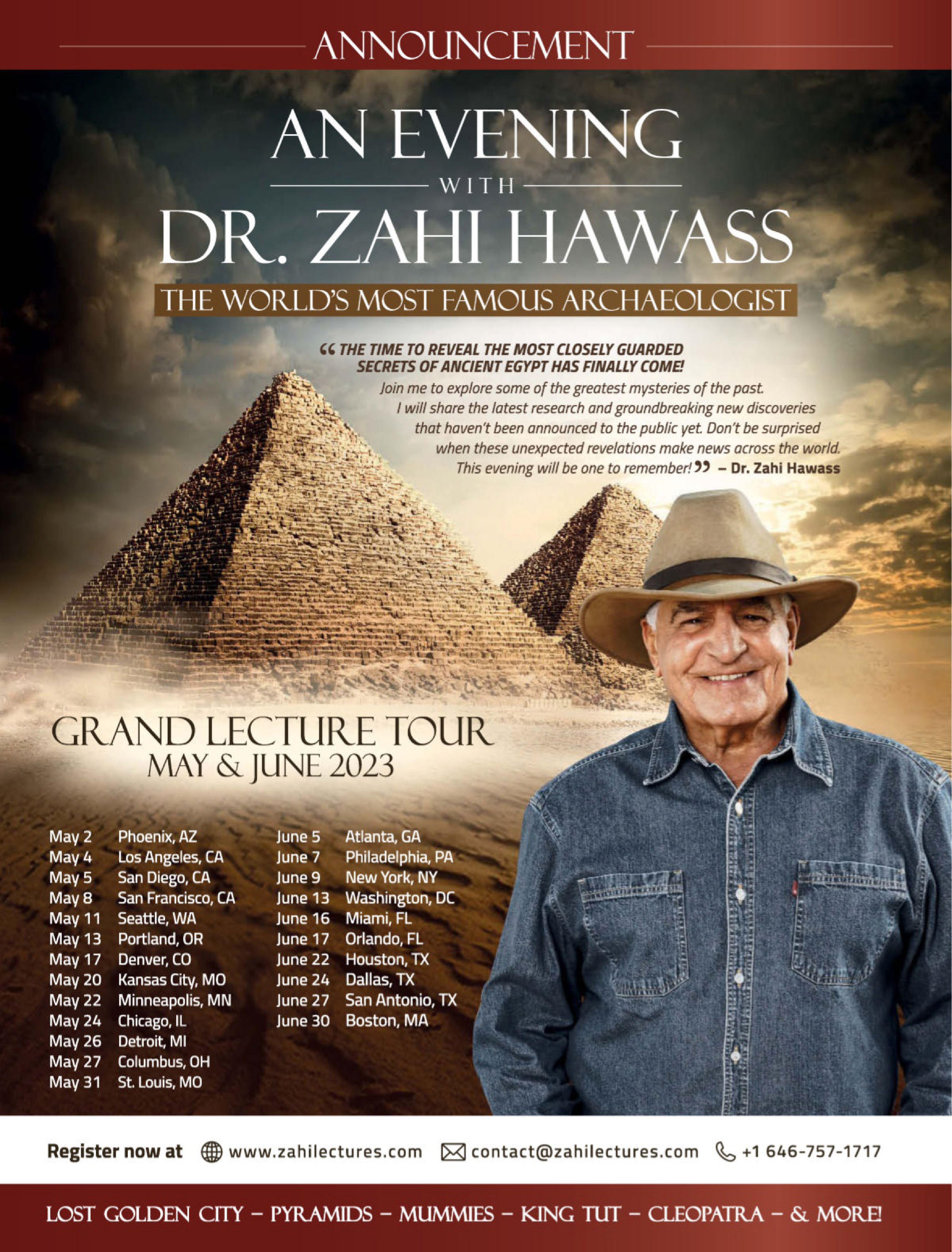
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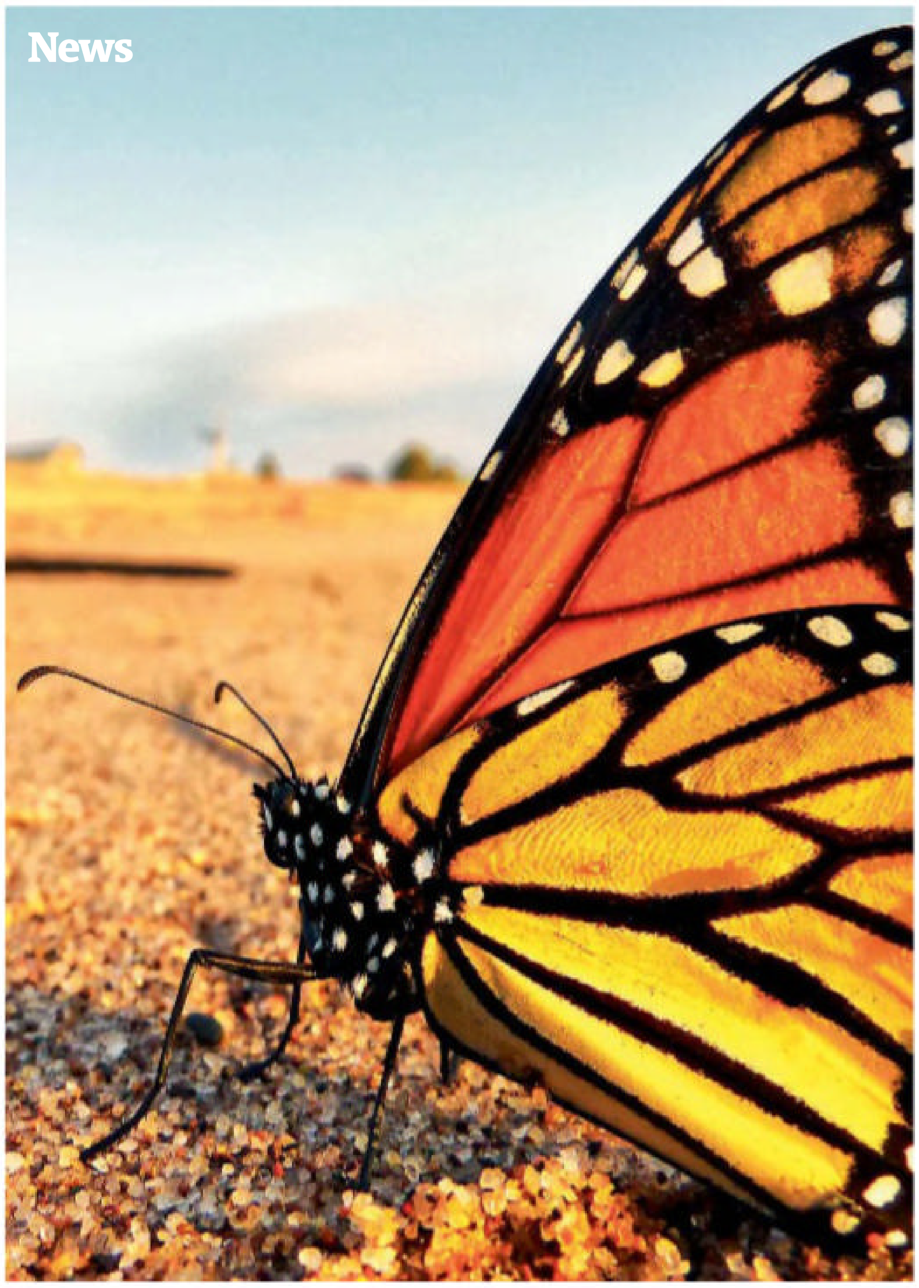
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Event

The Search for Dark Matter

Why do researchers believe in the existence of a substance we can't see and that no one has directly detected? Particle physicist Jocelyn Monroe and a panel of *New Scientist* journalists offer a deep dive into the science of dark matter. Join us at Conway Hall in London, or online, on 7 June at 7pm BST/2pm EDT. Tickets are free to this subscriber-only event.

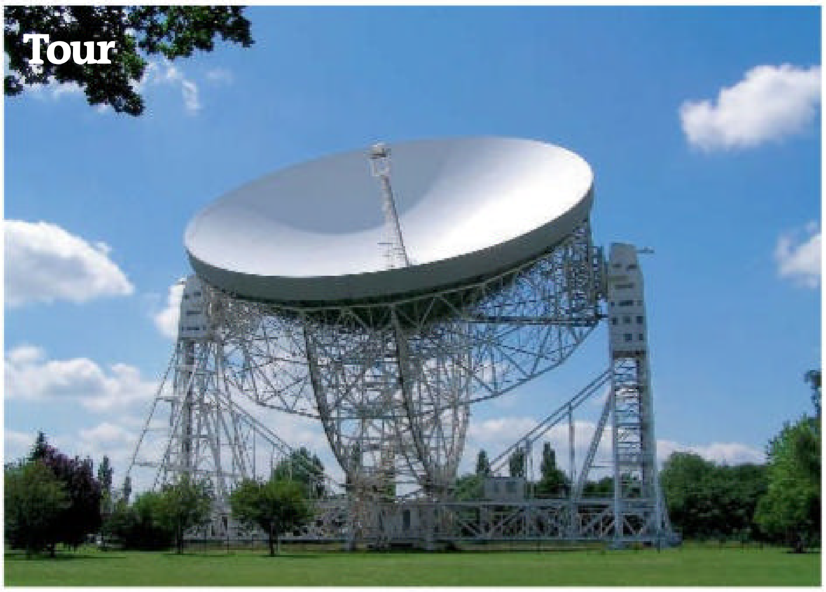
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Mysteries of the Universe, Cheshire, UK

Get to know the universe on this weekend getaway. You will visit the famous Jodrell Bank observatory, study the stars of the southern hemisphere through a remotely operated telescope based in Australia, and discuss astronomy with *New Scientist* features editor Abigail Beall and a team of astrophysicists. The three-day trip begins on 29 September. Early bird tickets are £859.

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ANDREW BARKER/SHUTTERSTOCK

Stargazer The Lovell radio telescope at Jodrell Bank, UK



CHRIS ROBBINS/ALAMY

Green diet Beef may be better for the planet than lab-grown meat

Podcast

Weekly

Lab-grown meat may be up to 25 times worse for the environment than traditional beef: the podcast team looks into why. There is also news of how Bach's organ music would sound when played on Mars. Plus, in a bonus episode, enjoy a guide to mind-bending concepts in science, including artificial intelligence and virtual particles.

newscientist.com/nspod

Video

Anatomical curiosities

The Hunterian Museum in London – home to thousands of specimens collected by 18th-century surgeon John Hunter – has reopened after a five-year redevelopment. On our YouTube channel this week, Susan Standring at King's College London and Dawn Kemp at the Royal College of Surgeons talk about the stories behind some of the exhibits.

youtube.com/newscientist

Newsletter

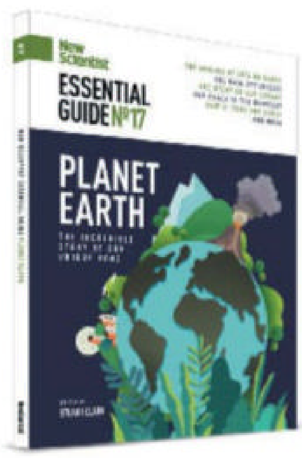
Health Check

Confused about the benefits of vitamin D? It isn't your fault, writes health reporter Clare Wilson; it reflects the way studies are performed. Observational studies might find a correlation between vitamin D levels and, say, your risk of illness from covid-19 – but a randomised trial may not find any link.

newscientist.com/health-check

Newsletter

"Vitamin D seemed to lower the risk from covid-19, but other trials showed this was false"



Essential guide

Our planet still has secrets to reveal. How did Earth form? How is it changing with global warming? And are there other Earth-like worlds out there? This *New Scientist Essential Guide* offers answers. Available to download in the *New Scientist* app or to purchase in print from our shop.

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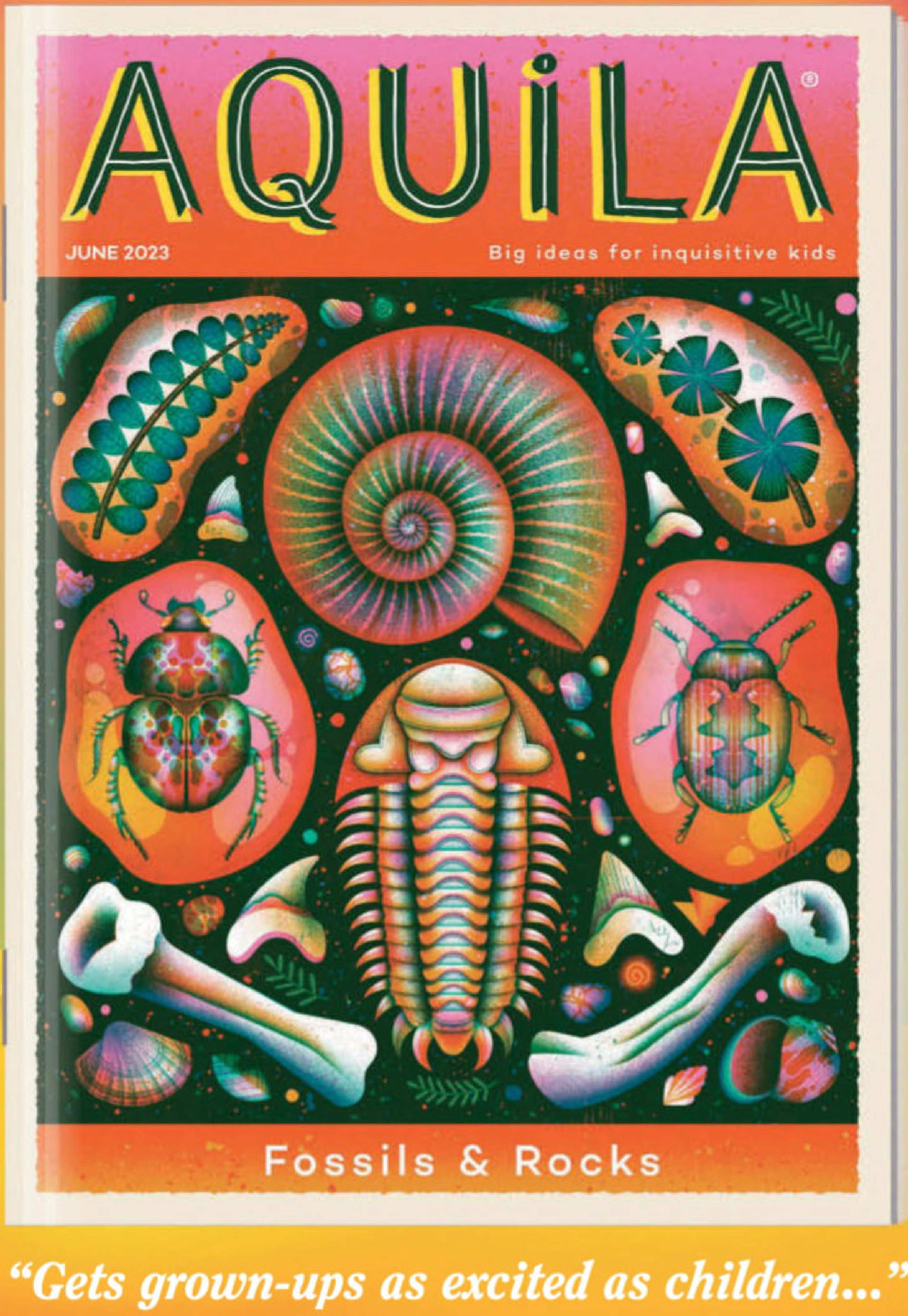
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Stick to the old plan

We can treat the symptoms of ageing without branding it a disease

OLD age can be seriously bad for your health. The list of age-related diseases is long and miserable, and as people get ever older, these tend to stack up. The average 80-year-old has four conditions; some have many more.

The good news is that there are a growing number of treatments designed to tackle these conditions, and more in the pipeline (see page 8). One very promising avenue is a class of drugs called senolytics, which take out zombie cells that are a direct cause of ageing (see page 38).

For now, the only option is to treat age-related diseases one at a time: dementia, say, or osteoporosis. But the underlying cause is the same – the ageing process itself – which has led to calls for ageing to be recognised as a disease in its own right. Proponents argue that this would allow the development of treatments to slow generalised decline and tackle multiple age-related diseases in one go.

This might seem like a no-brainer: surely it is better to deal with the root cause of ill health than to pick off its consequences one by one? But there are good counter-arguments. At present, there is no established measure of ageing that could be used to assess whether an experimental catch-all drug is working. Developing one will take time, money and effort that might be better spent working with the existing system. And people age in very different ways, so it may not even be possible to tackle it, per se.

> **"There have been calls for ageing to be recognised as a disease in its own right"**

The authorities tend to agree. Last year, the World Health Organization did a U-turn on adding "old age" to its International Classification of Diseases, and the US Food and Drug Administration has said it doesn't recognise ageing as a disease, even though it has authorised a clinical trial that looks very much like a general anti-ageing strategy.

This is arguably the correct approach. It is possible today to run trials of drugs for specific age-related diseases that could allow or even compel doctors to use the drugs off-label for other ones, if they think it might help. The current system ain't broke, so we don't need to fix it. ▮

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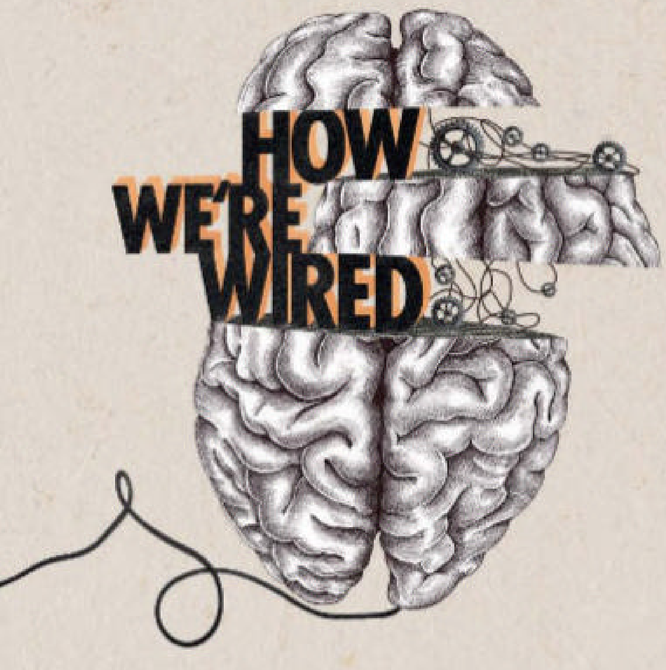
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News

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Having a worm infection helps ward off obesity **p10**

Alzheimer's clue
Genes that resist the disease may show how to beat it **p11**

Vehicle recycling
Can we create a circular motor industry? **p15**

Gas stopper
Kangaroo faeces could help cut cow emissions **p19**

Expanding picture
Odd supernova defies our understanding of the cosmos **p19**

Environment

Swiss village evacuated

A looming rockslide has seen the residents of the small Swiss village of Brienz evacuated from their homes. The village, which has a population of fewer than 100 people, has experienced subsidence for some time, causing large cracks to appear in its buildings.



REUTERS/DENIS BALIBOUSE

Ageing

Stem cell transplant extends life

Genetically modified blood stem cells have increased the lifespan of mice by 20 per cent and could soon be tested in a human cancer treatment, discovers **Michael Le Page**

A GENETIC modification has been discovered that protects mice against cancer as well as allowing them to live up to 20 per cent longer and remain healthy in older age. The benefits can be transferred to other mice by a transplant of blood stem cells.

"It was a big surprise," says Che-Kun James Shen at Taipei Medical University in Taiwan. "So far, we have not found any negative side effects."

Shen says his team is already collaborating with biotech firms interested in using the findings to improve cancer treatments in humans. Blood stem cell transplants are already part of the treatment for certain blood cancers and the hope is that making this genetic alteration to the transplanted cells will reduce the risk of cancers returning.

5 months

The amount lifespan is extended in mice given modified stem cells

If this proves successful, enough people might receive modified blood stem cells to show whether this extends human lifespan too.

Shen's team made the discovery while studying a protein called KLF1. This is a kind of master switch produced in some blood cells – including certain immune cells – that helps control the activity of many different genes.

Cells can alter the activity of KLF1 by attaching a chemical to a specific site on it. To study this, Shen's team created mice with a mutation in both copies of the *KLF1* gene that alters this bit of the protein.

Team member Yu-Chiau Shyu at Chang Gung Memorial Hospital in Taiwan noticed that these mice were unusually active in middle age and their hair stayed black and shiny for longer. This led the team to discover that the genetically engineered mice live between 10 and 20 per cent longer, says Shen.

What's more, they remain healthy for longer, with their physical and mental performance starting to decline later than they do in unmodified mice, and with less scarring in internal organs.

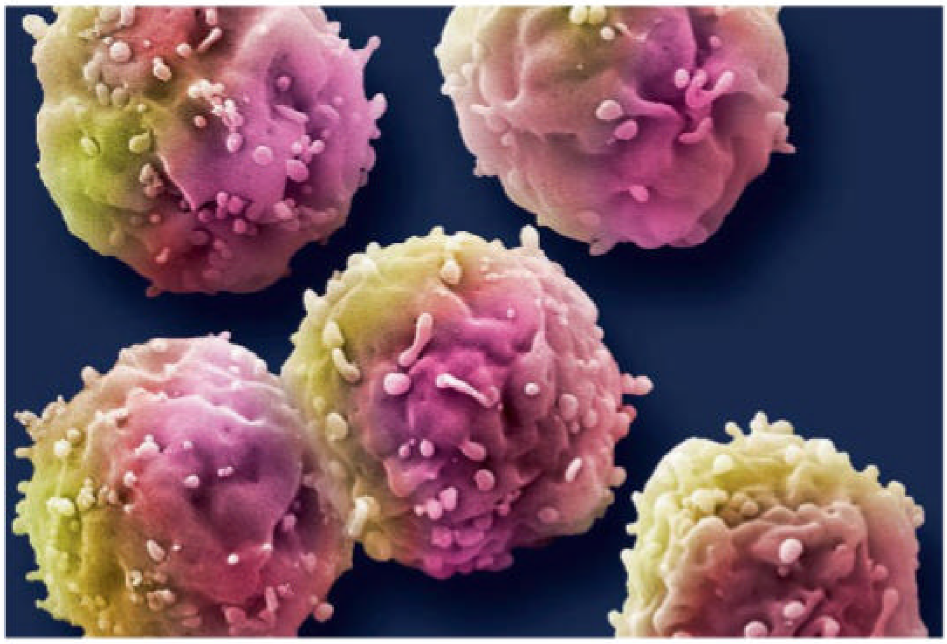
Researchers have identified many other genetic variants that increase the lifespan of mice. However, several extend the lives of females only and there is also no obvious way to confer their benefits to individuals born without these variants.

In this case, however, because blood cells were involved, the team tried taking certain types of blood cell from the modified mice and injecting them into unmodified mice. The team already reported last year that repeated injections of immune cells called T-cells every two weeks reduced the spread of cancers.

Now, the group has shown that 2-month-old mice given a transplant of modified blood stem cells typically live five months longer than those given unmodified cells, a boost of about 20 per cent. Two-month-old mice are roughly equivalent to 18-year-old people (bioRxiv, doi.org/j9tk).

The findings suggest that people's lifespans could be extended by removing some of their blood stem cells, modifying them to have this mutation and putting them back in the body. However, this procedure – which is similar to a bone marrow transplant – has risks, not least because the unmodified blood stem cells have to be killed off with chemotherapy or radiotherapy.

It is too early to think of trying this in people just to extend lifespan, says Shen. But for those already getting blood stem cell transplants to treat cancers, the risk-benefit balance is different.



STEVE GSCHMEISSNER/SCIENCE PHOTO LIBRARY

Blood stem cells can develop into any type of mature blood cell



VOISIN/PHANIE/SCIENCE PHOTO LIBRARY

Some future bone marrow transplants may include modified cells

"I am convinced of the life-extending properties of this mutation," says João Pedro de Magalhães at the University of Birmingham, UK. Many mutations that increase lifespan in mice do so by preventing cancer, he says, but this mutation appears to have wider benefits. He thinks gene editing blood stem cells has "great potential as a therapy for ageing".

Because mice with the mutation have better motor skills than non-modified mice as they age, Shen's team also tried transplanting the modified cells into mice that develop a condition resembling amyotrophic lateral sclerosis. ALS, also known as motor neurone disease, is characterised by loss of motor control and is untreatable. The transplants slowed its progression, says Shen.

The team has looked in genetic databases to see if any people have this mutation, but none were found. The group, has, however, identified one reason why this mutation has anticancer effects. It lowers levels of PD-1, a protein that many cancers exploit to evade immune attack. Several anticancer drugs work by inhibiting PD-1, and in some cell therapies for cancer, the *PD-1* gene is deleted.

Previous studies have shown that replacing the blood of an old mouse with blood from a young mouse can have rejuvenating effects. However, it is unclear why young blood has this effect or how to turn it into a practical therapy. ■

To read about the emergence of anti-ageing drugs, see page 38

Health

Irregular sleep linked to a higher risk of dying in next 7 years

David Cox

CONSISTENTLY going to bed and waking up at different times may throw our body's physiological processes out of sync and increase the risk of dying in a given period.

Matthew Pase at Monash University in Melbourne, Australia, and his colleagues studied sleeping habits of 88,975 people aged between 40 and 69, using records in the UK Biobank database.

From this information, they created a sleep regularity index (SRI) to reflect the likelihood that a participant would be awake at a particular time. Someone who goes to sleep and wakes at the same time every day would have an SRI of 100, while doing so at very different times would score 0, says Pase.

After calculating each participant's SRI across one week, the researchers followed up with them for seven years. Compared with the participants with the average SRI of 61, those who scored 41 or below were 53 per cent more likely to die from any cause over the seven-year follow-up. They were also 88 per cent more likely to die from heart disease and 36 per cent more likely to die from cancer specifically (medRxiv, doi.org/j9s5).

Pase says the results may be due to disruption to the body's roughly 24-hour circadian cycles. Such misalignment has been linked to cancer by triggering abnormal cell proliferation, he says.

Colin Espie at the University of Oxford says the result isn't unexpected. Sleep should be considered a critical factor like water, food or oxygen, he says.

Some participants had a diagnosed health condition at the start of the study – 41 per cent had a heart condition, for example, and 13 per cent had cancer. These can disrupt sleep, either through body changes or via anxiety, says Pase, which could influence the results. ∎

Analysis AI legislation

What is the future of artificial intelligence?

Google and the European Union both have a vision, but don't seem to be talking to each other, says **Chris Stokel-Walker**

THE race to roll out artificial intelligence is happening as quickly as the race to contain it, as two key moments last week demonstrate.

On 10 May, Google announced plans to deploy new large language models, which use machine-learning techniques to generate text, across its existing products. "We are reimagining all of our core products, including search," said Sundar Pichai, the CEO of Google's parent company Alphabet, at a press conference. The move is widely seen as a response to Microsoft adding similar functionality to its search engine, Bing.

> **"Firms are betting that their products are so seductive governments will have to adapt"**

A day later, politicians in the European Union agreed on new rules dictating how and when AI can be used. The bloc's AI Act has been years in the making, but has moved quickly to stay up to date: in the past month, legislators drafted and passed rules dictating the use of generative AIs, the popularity of which has exploded in the past six months. This includes a requirement to disclose the use of any copyrighted material in training such AIs. The draft text will be voted on in the European Parliament in June.

But Google, like Microsoft and other tech giants, seems to be paying little attention to what may soon become the world's most dominant form of AI legislation. Although EU laws only apply in member countries, the size of the bloc means companies globally can end up complying with its rules, as has broadly happened with the roll-out of the EU's General Data Protection Regulation (GDPR).

How do we square this contradiction? "I hope I'm wrong, but it seems to me that these companies ignoring copyright issues is a power move," says Carissa Véliz at the University of Oxford. "They are betting that their products are so seductive that governments will have to adapt to them, as opposed to these companies adapting their products to the rule of law."

While some AI firms have set up agreements to license copyrighted material, others appear to be taking the approach of begging for forgiveness, rather than asking for permission. The EU's AI Act may eventually force companies to formalise their use of copyrighted material, but how that will play out is unclear.



BLOOMBERG VIA GETTY IMAGES

Alphabet CEO Sundar Pichai reveals Google's use of new AI models

Copyright claims

Michael Veale at University College London thinks companies like Google will develop something similar to its Content ID system for YouTube, allowing rights-holders to claim content and choose to either remove it or monetise it. "I suspect AI firms are looking at similar models today, which would allow them both to play a compliance game while minimising costs by staying the price-setter, not the price-taker," he says. Google didn't respond to a request for comment.

Whatever happens, it is clear that the roll-out of AI is unlikely to slow down. "The speed at which companies are moving shows the strategic edge that AI will give today," says Benedict Macon-Cooney at the Tony Blair Institute for Global Change, UK. "This race could present profound opportunities, as a once-in-a-generation technology begins to be applied to accelerate science, health and industries old and new."

But the divergent paths being trodden by the tech giants and the EU set up a "struggle between titans, a clash between cultures", says Véliz. She believes that "humanity is at a crossroads" and the rules we establish now – or our failure to do so – will set the future direction of travel for years to come. ∎

Health

How parasites help ward off obesity

Infections with worms seem to tweak genes and boost the host's immune cells

Grace Wade

PARASITIC worms can modify mouse immune cells in a way that protects the animals from obesity, type 2 diabetes and heart disease. Therapies that mimic this may help us stave off such conditions.

We have long known that parasitic worm infections in humans are associated with lower rates of some diseases, but how it happens was a mystery.

To investigate, Keke Fairfax at the University of Utah and her colleagues infected 10 male mice with the water-borne parasite *Schistosoma mansoni* and compared them with nine uninfected males. All mice ate a high-fat diet and had been bred to be predisposed to obesity and cardiovascular disease.

After 10 weeks, the researchers took samples from the animals' bone marrow and cultivated them until immune cells called macrophages formed. These cells engulf pathogens and play a role in obesity-related insulin resistance and cardiovascular health.

On average, macrophages from infected mice consumed about 25 per cent more oxygen while resting than those from uninfected animals. Their ability to produce extra energy when needed was also about 250 per cent greater than that of cells from uninfected mice. This signifies that worm infections improve macrophage functioning.

Genetic analysis revealed changes in the activity of genes involved in regulating insulin and metabolising fats. This suggests parasitic worms protect their hosts by altering gene expression in the immune cells, says Fairfax.

To confirm that, the researchers transferred bone marrow from infected mice to uninfected males. After 10 weeks, these mice weighed less and had better blood sugar regulation than those that got bone marrow from uninfected mice (*PLoS Pathogens*, doi.org/j9s8).

"It could be that susceptibility to type 2 diabetes or other metabolic conditions is permanently changed by an episode like this. That's really exciting," says Rick Maizels at the University of Glasgow, UK.

"I'm obviously not out here recommending that everybody be infected with [parasitic worms]," says Fairfax, who presented these findings in April at a New York Academy of Sciences symposium in New York City. But if we can identify the molecules the worms produce to alter macrophage function, we will have new pharmaceutical targets, she says.

It all makes sense from an evolutionary perspective, says Fairfax. Mammal immune systems have evolved in the presence of these worms, she says, and there is an advantage for worms if their hosts are healthier.

There are limits to the symbiosis, though. When the experiments were done in female mice, there was no effect. Only when the ovaries were removed, causing the hormones oestrogen and progesterone to plummet, did infection protect against disease. This suggests that a therapy mimicking the effect of the worms won't work in premenopausal women, says Fairfax. ■

Parasitic worms such as *Schistosoma mansoni* bring some benefits



SCOTT CAMAZINE/ALAMY

Technology

Colour-changing wrap tells you when food has spoiled

BIODEGRADABLE food packaging could alert people to food that is spoiling by changing colour.

Best-before labels are often poor predictors of when food becomes dangerous to eat, which can lead to waste and food poisoning, says Benedetto Marelli at the Massachusetts Institute of Technology. So, he and his colleagues tried to create wrap that can react to changes in food.

They made four films similar to plastic wrap, each consisting of two layers. One layer was made from a protein extracted from silkworm silk, while the other was made of one of four so-called covalent organic frameworks (COFs). These materials contain carbon and hydrogen, as well as atoms like oxygen or nitrogen, all arranged in a grid that makes the material porous.

After checking the films were non-toxic and robust, the researchers tried to compost them. For the best performing film, 50 per cent of it degraded after being placed in soil for 30 days, which is comparable to existing biodegradable plastics.

The material also changed colour when immersed in solutions with different pH values, due to the COF layer's interaction with the liquid. Because the pH of food increases as it spoils, the researchers tried to use a piece of the film as a colour-changing label attached to a packet of raw chicken. The label started off orange but turned yellow and got 17 per cent lighter after 20 hours at 30°C (86°F), indicating that the meat had begun to spoil (*ACS Nano*, doi.org/j9s7).

20 hours

The food wrap lightened after this long, indicating chicken was spoiling

The researchers also loaded the COF layer with an antimicrobial chemical. After 15 days, soya beans packaged in the film and left in high heat and humidity had about a third as much mould as beans wrapped in conventional plastic.

To make a real impact, the material will need to be affordable and easy to produce. "The bar for competing with plastic production is very high," says Marelli. ■

Karmela Padavic-Callaghan

Health

Genes that give partial resistance to Alzheimer's may show how to beat it

Clare Wilson

A FEW people with genetic resistance to Alzheimer's disease are causing a rethink of the condition's biological causes that could lead to new treatments.

Their experience suggests that a protein called tau, which builds up inside the brain cells in people with Alzheimer's, could be at least as important to the progression of the condition as the current chief suspect, another protein called beta-amyloid.

Drugs are in development that aim to reduce the memory loss and confusion caused by Alzheimer's by lowering levels of amyloid, but their effects are small – so small, in fact, that they may not be approved for use in some countries.

The people with at least some resistance to Alzheimer's are part of a community living in Colombia with high levels of a risky gene variant called *PSEN1-280A*, discovered in the 1980s.

This variant is thought to have been introduced by a Spanish conquistador in the 17th century. The people who carry it are spread across about 25 families living in an isolated region of the Andes mountains.

The gene encodes an enzyme involved in making amyloid and people with one copy of the risky variant were thought to inevitably develop Alzheimer's in their 40s.

But in 2019, a woman was discovered who, as well as carrying the harmful mutation, also has two copies of a rare variant, called *APOE3* Christchurch, of a different gene. This gave partial protection against what otherwise would have been her genetic fate of early-onset Alzheimer's. Instead of developing it in her 40s, she got the dementia in her 70s.

Now, while studying this Colombian community, Diego Sepulveda-Falla at University Medical Center Hamburg-Eppendorf in Germany and his colleagues have found a second similar case: a Colombian man who carries both the harmful mutation *PSEN1-280A* and a copy of a different rare variant, called *RELN-COLBOS*. This also seemed to give him partial protection, because he too didn't develop Alzheimer's until he was in his 70s.



STEVE RUSSELL/TORONTO STAR VIA GETTY IMAGES

This Colombian family has a gene mutation that causes early-onset Alzheimer's

"Once may be chance, twice sounds like something different. There may be more cases to be detected"

"Once may be chance, twice sounds like something different," says Sepulveda-Falla. "There might be even more protected cases yet to be detected."

Both the man and woman had extensive build-up of amyloid in their brain, as would be expected given they had *PSEN1-280A*. But their levels of tau were lower than is usually seen in Alzheimer's – hinting that tau is chiefly responsible for the symptoms of memory loss and confusion (*Nature Medicine*, doi.org/j9t3).

"Tau is more important [than amyloid]," says Sepulveda-Falla. "I think we have enough evidence to say it."

The man also had a sister with both the harmful mutation and one copy of the newly discovered protective variant. She seems to have been protected, but less so, because she had severe dementia when she was first evaluated at 64.

In separate research, the team has found that a few people in the Colombian community have a single copy of the Christchurch protective mutation, as well as the risky Alzheimer's variant, and they also seem to have a moderate delay of dementia onset, says Sepulveda-Falla.

Because the woman who had two copies of Christchurch had a long delay before developing the condition, "it seems this is pretty much a dose-dependent effect", says Sepulveda-Falla. No further details are available because this research hasn't yet been published.

The two protective gene variants seem to affect the tau protein in different ways. The damage to brain cells in Alzheimer's is usually linked with a build-up of tau that has been chemically modified in a process called phosphorylation.

When the team gave the protective *RELN-COLBOS* gene variant to mice, it reduced their phosphorylation of tau.

Memory centres

Interestingly, while the woman with the Christchurch mutation had low levels of phosphorylated tau throughout her brain, the man with the *RELN-COLBOS* variant lacked phosphorylated tau in a small part of the brain: the entorhinal cortex. This acts as a gateway for information going into or leaving the hippocampus, the brain's memory centre.

It is widely suspected that in the early stages of Alzheimer's disease, tau build-up begins in the entorhinal cortex.

"The fact that [the man] was able to delay the initiation of damage for 30 years with reduction in phosphorylation in this specific area is a very significant finding," says Stephanie Fowler at University College London.

Treatments called antisense oligonucleotides that reduce how much tau is manufactured in cells are in development, says Fowler. "If we can only protect this one area, seemingly that's enough."

Richard Oakley at UK charity the Alzheimer's Society says the findings support the idea that while amyloid is important among the condition's causes, it isn't the only factor. "Understanding this kind of resilience could highlight other future targets for drugs," he says. ■

Evolution

Butterflies evolved in North America

Genetic analysis hints butterflies arose 100 million years ago, before the dinosaur extinction

Jake Buehler

BUTTERFLIES first fluttered onto the scene in North America about 100 million years ago, according to a genetic analysis. The findings have been used to generate a detailed family tree for these insects, giving us insights into how they spread across the world.

"The family relationships and the history of butterflies, surprisingly, is not very well known," says Akito Kawahara at the University of Florida.

Kawahara and his colleagues looked at butterflies in 28 museum collections. They analysed 391 genes from nearly 2300 species, which came from 90 countries and represented 92 per cent of all known butterfly genera.

Pável Matos-Maraví at the Czech Academy of Sciences says he is impressed by the "unprecedented amount of data handled" in the study.

The researchers used genetic analysis to date when butterfly groups split apart from each other, and determined the most likely geographic origin of the first butterflies. They estimate that the earliest butterflies evolved about 100 million years ago.



KATHERENES/SHUTTERSTOCK

Black swallowtails can be seen in much of North America, where their family evolved

This confirms earlier research that suggested similar timing. Butterflies evolved from nocturnal moths following the proliferation of flowering plants during the Early Cretaceous Period. They exploited the new food resource and took advantage of the co-evolutionary relationship that was forming between flowering plants and bees, says Kawahara.

This seems to have happened in North America, against a backdrop of bony-plated herbivorous dinosaurs and fleet-footed ancestors of *Tyrannosaurus rex*. This was a surprise to Kawahara.

"Some people had thought that because there's a pretty high diversity of butterflies in Asia, that was the origin," he says.

From North America, the insects dispersed, first into South America and then westward to Australia, Asia and India, which were then an island subcontinent. Next, butterflies flapped into Africa, then finally reached Europe about 17 million years ago (*Nature Ecology and Evolution*, doi.org/j9t7).

The researchers also compiled more than 31,000 records of plants eaten by butterfly larvae, reconstructing the evolution of these plants alongside the butterflies. They think the first caterpillars munched on plants in the legume family. Today, more than two-thirds of butterfly species still eat only plants in that family, while the others have more varied, generalist diets.

Knowledge about evolutionary connections between butterflies and host plants may aid conservation, says Kawahara.

> "Butterflies are highly studied, but my gosh, we still have a lot of work to do"

The findings also imply we need to revise the butterfly family tree. The researchers estimate that 27 per cent of all butterfly tribes – collections of genera smaller than a family – are mistakenly grouped with others.

Butterflies are highly studied, says Kawahara, "but my gosh, we still have a lot of work to do".

...while those alive today must adapt to climate change

THE evolution of butterflies continues apace. Species with larger wingspans have expanded their range in high-latitude parts of North America as the climate has warmed, while smaller butterflies and those adapted to cold conditions have tended to decline.

Vaughn Shirey at Georgetown University in Washington DC and his colleagues built a computational model to analyse the presence of 90 butterfly species above 45° north in North America from 1970 to 2019.

The team analysed how shifting monthly minimum temperatures over the past 50 years may have affected the ranges of butterflies.



DON JOHNSTON_IH/ALAMY

Monarch butterflies seem to be declining in number because of climate change

The monthly minimum temperatures increased by 0.86°C (1.5°F), on average, across the study region from the 1970s to the 2010s. As temperatures rose, butterfly species with larger wingspans were more likely to spread out into a greater proportion of the study region. But for smaller butterflies, rising temperatures were linked with a decrease in the area over which they were found.

"It seems logical to assume that, if species with larger wingspans have the capacity to better travel to new suitable habitats, it gives those species an advantage in a changing climate," says Yoan Fourcade at the Institute of Ecology and Environmental Sciences in Paris.

Butterflies adapted to warmer temperatures also seemed to have dispersed more across the study region than those adapted to colder climates (bioRxiv, doi.org/j9s4).

Climate change has been linked with a fall in some butterfly species, including the monarch (*Danaus plexippus*) in North America. But some appear to be adapting: a 2022 study found that British butterflies are steadily getting bigger in response to rising temperatures.

Carissa Wong

Health

Stimulating the clitoris electrically could treat low libido

Carissa Wong

USING electrical impulses to stimulate the clitoris could increase arousal to treat low libido.

A degree of sexual dysfunction affects an estimated 2 in 5 pre-menopausal women globally. Symptoms vary and can include not feeling aroused, struggling to orgasm and experiencing pain or discomfort during sex. It can be caused by many factors, including stress, hormonal changes, spinal cord injuries or arthritis.

Elizabeth Bottorff at the University of Michigan and her colleagues explored whether applying electrical impulses to the dorsal genital nerve – which is involved in sexual pleasure – in the clitoris would increase arousal in five women, two of whom had spinal cord injuries. All had sexual dysfunction, as assessed via a survey. No transgender people were included in the study.

The researchers used two circular electrodes on the clitoris of each woman to apply weak electrical impulses for half an hour.

Participants ranked how sexually aroused they felt before and after stimulation. The three participants without a spinal cord injury reported that their arousal increased by 1 to 2 points on a 5-point scale, while the two with a spinal cord injury reported an increase of 2 to 3 points (medRxiv, doi.org/j9tb).

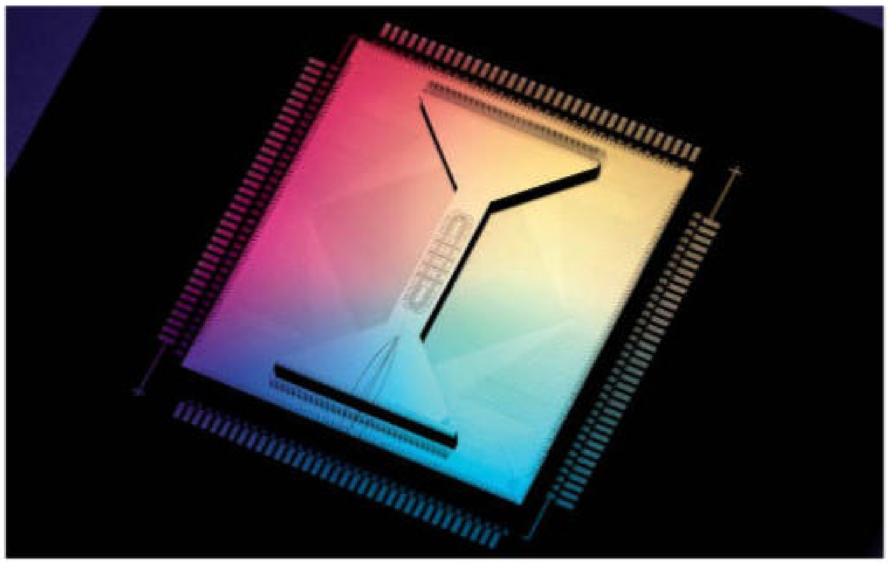
It is unclear how long the effects last, but repeated stimulation sessions may lead to more pronounced improvements in sexual function, say the researchers.

"With [electrical stimulation] of any nerve, there is usually an instant result that fades with time, but sexual arousal and payoff can go beyond direct stimulation," says Stacy Elliott at the University of British Columbia, Canada. Repeatedly using it to help "rewire the brain" would probably have long-term effects, but larger studies are needed, she says. ■

Physics

Particle that remembers its past discovered by quantum computer

Alex Wilkins



QUANTINUUM

The H2 quantum processor has discovered particles called anyons

A MYSTERIOUS and long-sought particle with a memory has been discovered using a quantum computer. The particle, called an anyon, could improve the performance of future quantum computers.

The anyon is unlike any other particle we know because it keeps a kind of record of where it has been. Normally, the repeated swapping of particles like electrons or photons renders them exchangeable, making it impossible to tell a swap has taken place.

But in the 1970s, physicists realised this wasn't the case for certain quasiparticles that can exist only in two dimensions, which were later dubbed anyons. Quasiparticles, as the name suggests, aren't true particles, but rather collective vibrations that behave as if they are particles.

Unlike with other particles, swapping anyons fundamentally changes them, with the number of swaps influencing the way they vibrate. Groups of a particular variety, called a non-Abelian anyon, bear a memory of the order in which they were swapped, just as a braided piece of rope retains the order in which its strands have been crossed over. But where the threads of a rope interact physically, anyons interact through the strange quantum phenomena of entanglement, where particle properties are linked through space.

> "Anyons don't care what they're made of. They're just about information and entanglement"

This inherent memory and the quasiparticles' quantum nature make non-Abelian anyons an attractive way to do quantum computing, but they had never been found experimentally.

Now, Henrik Dryer at quantum computing firm Quantinuum and his colleagues say they have done just that. The researchers developed a new quantum processor called H2, which uses ytterbium and barium ions trapped using magnetic fields and lasers to create qubits, or quantum bits, the basic building blocks of a quantum computer.

They then entangled these qubits in a formation called a Kagome lattice, a pattern of interlocking stars seen in woven Japanese baskets. This gave the qubits identical quantum mechanical properties to those predicted for anyons and, when the team adjusted the interactions between the qubits in a way that was equivalent to moving the anyons, they could test for and confirm the swap-dependent changes to the anyons' properties (arXiv, doi.org/gr7xth).

"This is the first convincing test that's been able to do that, so this would be the first case of what you would call non-Abelian topological order," says Steven Simon at the University of Oxford. The fact that you can play around with the anyons using the quantum computer is also useful for researchers who want to better understand this exotic state of matter, he says.

Not everyone agrees that Quantinuum has created non-Abelian anyons, rather than merely simulating them. "I know they're very excited about their work and they should be excited, but it is still a simulation," says Jiannis Pachos at the University of Leeds, UK. That means it might lack certain properties present in the real thing, he says.

Dryer takes a different view, saying that the quasiparticle nature of anyons means a simulation is identical to the real thing. "A counterintuitive property of these anyons is that they are not really physical, they don't care what they're made of," he says. "They're just about information and entanglement – so if you have any system that can create that kind of entanglement, you can create the same type of anyons." ■

Atmospheric science

Mysterious sounds in stratosphere can't be traced to any known source

Karmela Padavic-Callaghan

SOLAR-powered balloons floating in the stratosphere have recorded low-frequency sounds that we don't know the origin of.

"When we started flying balloons years ago, we didn't really know what we'd hear," says Daniel Bowman at Sandia National Laboratories in New Mexico. "We learned how to identify sounds from explosions, meteor crashes, aircraft, thunderstorms and cities. But virtually every time we send balloons up, we find sounds that we cannot identify."

Bowman and his colleagues measured infrasound signals – sounds with a frequency so low they are inaudible to human ears – using solar-powered balloons floating 20 kilometres high.

The researchers built the 7-metre balloons from thin plastic, filling them with charcoal powder, which heats up in sunlight and makes the balloon float.

Unlike weather balloons, which rise until they pop, these solar-powered balloons coasted in the stratosphere for many hours, carrying infrasound sensors over hundreds of kilometres. The researchers deployed more than 50 balloons over the course of seven years starting in 2016.

The data collected reveals that the stratosphere sounds different to the surface of Earth. On the ground, infrasound sensors pick up signals that have been deflected by winds on their way down, but the balloons floated above those winds – they recorded signatures of turbulence in other parts of the atmosphere, and infrasonic sounds of marine storms.

However, Bowman says many infrasound signals from the stratosphere didn't have an obvious origin. He presented the work at a meeting of the Acoustical Society of America in Chicago, Illinois, on 11 May.

These mysterious signals could be related to types of atmospheric turbulence, but infrasounds in the stratosphere have rarely been explored so it is hard to make educated guesses, says Bowman.

Above the winds and the clouds, you detect strange sounds



CHALEEPHOTO/SHUTTERSTOCK

He says one of the first balloon studies of this kind was a US Army Air Forces experiment code-named Project Mogul, which sought to detect infrasound signals of nuclear weapons tests in the Soviet Union in the 1940s. One of Project Mogul's balloons crashed in Roswell, New Mexico, which brought the top-secret project into the public eye. The cover-up to conceal its purpose sparked UFO conspiracies, and most of the data from the balloon flights, ending in the 1960s, stayed classified, says Bowman.

Roger Waxler at the University of Mississippi isn't surprised by enigmatic infrasound signals. "On the ground, you can put sensors into arrays and know exactly where they are relative to each other, which helps calculate where an infrasound came from. With balloons, they just go where they go," he says.

Bowman is collaborating with NASA to adapt the solar-powered balloons to record infrasound on Venus, which could help chronicle the planet's seismic activity. ■

Health

Your body wash may draw more mosquitoes to you

THE body wash you use seems to react with your natural odour to change how attractive you are to mosquitoes.

To investigate if body wash influences how many mosquitoes people attract, Clément Vinauger at Virginia Polytechnic Institute and State University and his colleagues selected varieties from the brands Dial, Dove, Native and Simple Truth.

They placed strips of nylon on one of the forearms of four volunteers and wrapped the area in foil, to collect the natural odour.

Next, for each product, the researchers washed part of the other forearm with about 1 gram of body wash for 10 seconds, before rinsing it with water. They then used strips to collect the wash's scent.

The researchers put body wash-free and body wash-exposed strips inside cages with 16 to 25 female *Aedes aegypti* mosquitoes, which were free to visit either strip.

The Simple Truth body wash increased the attractiveness to mosquitoes of all participants, measured by the number of times the insects landed on the body-wash strips compared with the body wash-free strips. The Dove product had a similar effect, but the boost in attractiveness was only pronounced for three of the participants.

Dial's body wash also made the participants more attractive to mosquitoes, but to a lesser extent than Simple Truth's or Dove's.

In contrast, mosquitoes tended to avoid strips with Native body wash, and displayed a strong aversion to one person's Native-washed strip (*iScience*, doi.org/gr7x6j).

"The soap chemicals and the body odour interact to make you more or less attractive to mosquitoes"

"Our study highlights the importance of the interaction between the specific soap chemicals and the body odour of each person in determining whether a person would become more or less attractive to mosquitoes," says Vinauger.

New Scientist contacted the four manufacturers of the body washes for comment, but received no reply prior to publication. ■

Soumya Sagar

Can we create a circular motor industry?

Graham Lawton grabs a power tool and gets to grips with a new way to recycle vehicles



I AM not much of a petrolhead and I have never taken a car to pieces before, but there is a first time for everything. I don my gloves, grip a power tool and get to work. After a bit of huffing and puffing, one of the doors comes off and is spirited away by an overhead hoist.

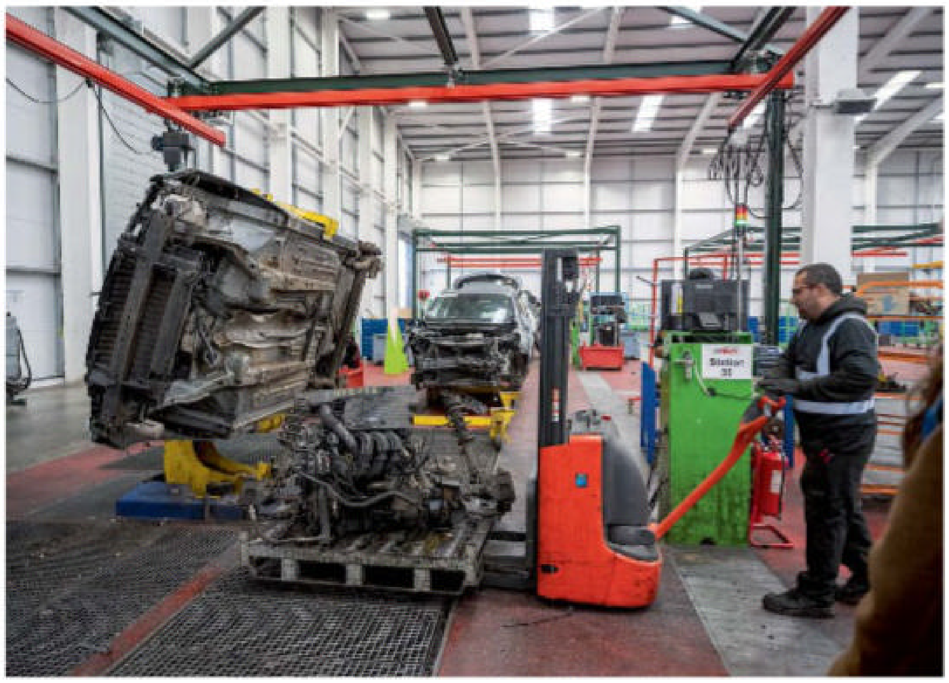
I am at a car breakers' yard in Poole, UK, to witness the cutting edge of vehicle recycling. Last August, traditional scrapyard Charles Trent reinvented itself as one of Europe's most advanced "de-production" facilities.

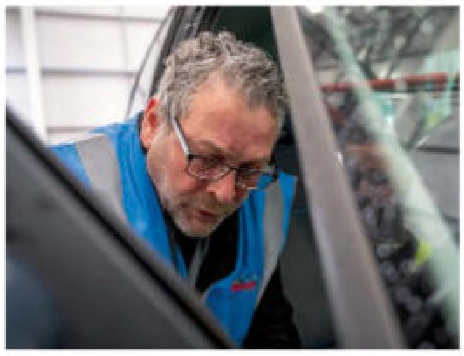
"The concept is based on production lines where cars are constructed," says Neil Joslin, the company's chief operating officer. "Can we do that in reverse?"

The answer is yes. Its new facility, which cost more than £10 million, houses what looks like a standard production line, but instead of constructing cars, it deconstructs them. Whole cars enter the line at one end; their skeletal remains emerge from the other. In between, everything that might be reused is stripped off the carcass and sent for processing. Most of the rest is recycled.

Of the total weight of cars entering the facility, 96.3 per cent of it is reused or recycled, according to CEO Marc Trent. That is above the 95 per cent target in law, and higher than the UK average, which is officially put at 93 per cent, but is probably much lower, according to Chas Ambrose at the Vehicle Recyclers' Association. Charles Trent is more systematic than your average salvager, which might scavenge a few juicy parts, but send most of the car to be crushed.

The firm carefully selects which vehicles to buy to maximise saleable parts. "A big challenge for us is to understand our customers' demand for parts. We have a team of data analysts," says Joslin. "We're very targeted at the parts we take."







RICH PEARCE PHOTOGRAPHY; STUART G W PRICE

Clockwise from below left: Graham Lawton removing a door; a car disassembly line; boxed parts packed for resale

The deconstruction journey begins with cars arriving on trucks. About 120 a day come in – most of them having reached the end of their natural life, but also some insurance write-offs.

Next comes triage, where engineers examine the car to identify potentially salvageable bits. They then slap bar codes on the cars that detail which bits to extract and keep, if the vehicle makes the cut.

The wheels, tyres and battery are removed. Saleable ones are put to one side; useless ones are sent for recycling elsewhere. All the cars' fluids – including fuel, oil and water – are drained out and cleaned for use in the site's own vehicles. The car then enters the de-production line and a countdown begins.

The line has four stations specialising in different stages of the process. Each is staffed by an engineer, who scans the bar code and follows its instructions. They have 15 minutes to complete the checklist.

96.3%

Proportion of the weight of cars arriving that is reused or recycled

The first station does doors, panels and interiors; the second lights and dashboards; the third moving parts – engines, gearboxes and axles plus catalytic converters; and the final electricals.

At station three, I watch as a car is hoisted up on a mighty robotic arm so an engineer can cut out the engine, which will go through a special engine washing machine, be labelled and assessed for its reusability. All parts are similarly checked and the useable ones put on sale on eBay – the UK's leading retailer of car parts – with a "certified recycled" guarantee and a record of its provenance.

The final stage of the process is to send the remains of the car to be crushed in a baler, from where it will be sent to a scrap-metal merchant. The whole de-production process takes about an hour and the facility processes 75 cars a day. The rest of the day's arrivals are crushed before they, too, go to a scrap-metal merchant.

The point of the processing is to create a more circular car industry and a thriving spare-parts business. Vehicle parts are in short supply in the UK – in part due to Brexit – and repairs using new ones can take months. Many cars end up being needlessly written off due to lack of parts, says Trent.

Meanwhile, consumers and repairers are more willing than they once were to accept used parts, he says, especially when they come with a guarantee. The fact that they are greener and 70 per cent cheaper doesn't hurt.

Circularity is also better for the environment. The facility has already cut the company's carbon footprint by the equivalent of 16,000 tonnes of carbon dioxide and kept 3000 tonnes of waste from going to landfill, according to an analysis by eBay.

The ultimate goal is to reuse or recycle the whole vehicle. "Within the next couple of years, our target will be to close that recycling loop to nearly 100 per cent," says Trent. "This is the future of car recycling." ∎

Psychology

Young children value the lives of animals more than adults do

Alice Klein

IF YOU had to save the life of a person or an animal, which would you choose? Most adults say they would pick the person, but almost half of young children would prefer to save the animal, according to a study in Poland.

"The finding really surprised us," says Matti Wilks at the University of Edinburgh, UK.

Most adults view human life as especially precious. For example, a survey of millions of people in 233 countries, most of them in their 20s and 30s, found they largely agreed that self-driving cars should crash into dogs or cats instead of people if they had to choose.

However, growing evidence suggests many young children feel differently. Using a toy railway and Lego figures, Wilks and her colleagues presented 170 children aged 6 to 9 in an urban part of Poland with scenarios based on a thought experiment called the trolley problem.

The children had to decide whether to direct a runaway rail car down one of two tracks so that it crashed into a Lego person or a Lego animal – either a dog or chimpanzee. For comparison, the researchers repeated this with 178 Polish adults aged 18 to 50.

About 42 per cent of the children wanted to save the dog and make the rail car collide with the person, compared with just 17 per cent of adults. About 28 per cent of children also prioritised the chimpanzee over the person, compared with 11 per cent of adults (PsyArXiv, doi.org/j9gq).

Children who spend time with dogs are more likely to say they would save them



JOHN HOWARD/GETTY IMAGES

Wilks and her colleagues have previously found that 28 per cent of children aged 5 to 9 in urban areas of New England in the US said they would save a dog over a person if they had to rescue one from a sinking ship, compared with 8 per cent of adults. About 18 per cent of children in that study also said they would save a pig over a person, compared with 3 per cent of adults.

"Children learn from their parents, teachers and others that it's really important to care for others, but it may be easier for them to learn this as a blanket rule that applies to both humans and animals," says Karri Neldner at the Max Planck Institute for Evolutionary Anthropology in Germany. As a result, they don't show a strong preference for saving one over the other, she says.

"However, as they get older, they might pick up on cultural narratives that tell us it's really important to care for other people," says Neldner.

Her research suggests this shift starts by the age of 10. When she asked Australian children aged 4 to 10 to order pictures of people, animals, plants and objects according to how much they cared about them, the 4-year-olds tended to care more about dogs, cats and dolphins than about classmates, police officers and sick people, but this was reversed in the 10-year-olds.

The reason children value dogs so highly is probably due to familiarity, says Wilks. Her studies have found that children who spent more time with dogs were more likely to say they would save a dog over a person. ■

Physics

Quantum computer circuits pass key entanglement test

A SUPERCONDUCTING circuit has passed a Bell test, the gold-standard confirmation of quantum behaviour. These circuits are used in quantum computers, and the result proves their quantum bits are entangled.

When two particles are entangled, measuring the characteristics of one instantly affects the measured characteristics of the other, in what is called a non-local correlation. When this happens, it means the effects of the entanglement must travel faster than light. The test for this quantum effect is called Bell's inequality, which sets a limit on how often particles can end up in the same state by chance without actual entanglement. Violating Bell's inequality is proof that a pair of particles are, in fact, entangled.

For the test, the two entangled systems have to be far enough apart that a signal couldn't have travelled between them at the speed of light in the time it takes to measure both systems. This is difficult to test in a superconducting circuit because the whole thing has to be kept at temperatures near absolute zero.

To do it, Simon Storz at the Swiss Federal Institute of Technology in Zurich and his colleagues joined the two entangled parts of the circuit – called quantum bits, or qubits – using microwaves sent through a chilled 30-metre aluminium tube, while keeping each qubit in its own fridge. They then used a random number generator to decide what measurement to make on the qubits to avoid human bias.

12,500

The number of measurements taken per second in the Bell test

The researchers made more than 4 million measurements at a rate of 12,500 per second. They found that Bell's inequality was violated and the qubits were undergoing what Albert Einstein termed "spooky action at a distance", as expected (*Nature*, doi.org/gr7zn2).

Connecting the qubits across such a distance also shows that superconducting circuit-based quantum computers could be scaled up to create quantum supercomputers, says Storz. ■

Leah Crane

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ONLINE AND IN-PERSON EVENT

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Environment

Kangaroo faeces transplants may cut cow emissions

Saugat Bolakhe

BACTERIA from kangaroo faeces transplanted into cow stomachs might reduce the massive amount of methane the ruminants produce.

Methane has a warming effect in the atmosphere that is almost 30 times more potent than that of carbon dioxide. About half of global methane emissions come from ruminants like cows, which harbour bacteria called methanogens in their stomachs. These bacteria consume hydrogen gas – produced by the digestion of sugars – and use it to make methane, which is then released from the animal's body.

People have tried various feed additives for reducing methanogens in ruminants, such as antibiotics and plant extracts. However, the bacteria were either too robust to be replaced or the antibiotics upset the animals' digestion.

To look for alternatives, Birgitte Ahring at Washington State University and her colleagues turned to kangaroos, whose gut microbiota contain bacteria that use hydrogen and carbon dioxide to make acetic acid instead of methane.

The researchers collected droppings from baby kangaroos and grew the microorganisms present in them in the lab. They then placed the faecal culture in a bioreactor designed to mimic the contents of a cow stomach.

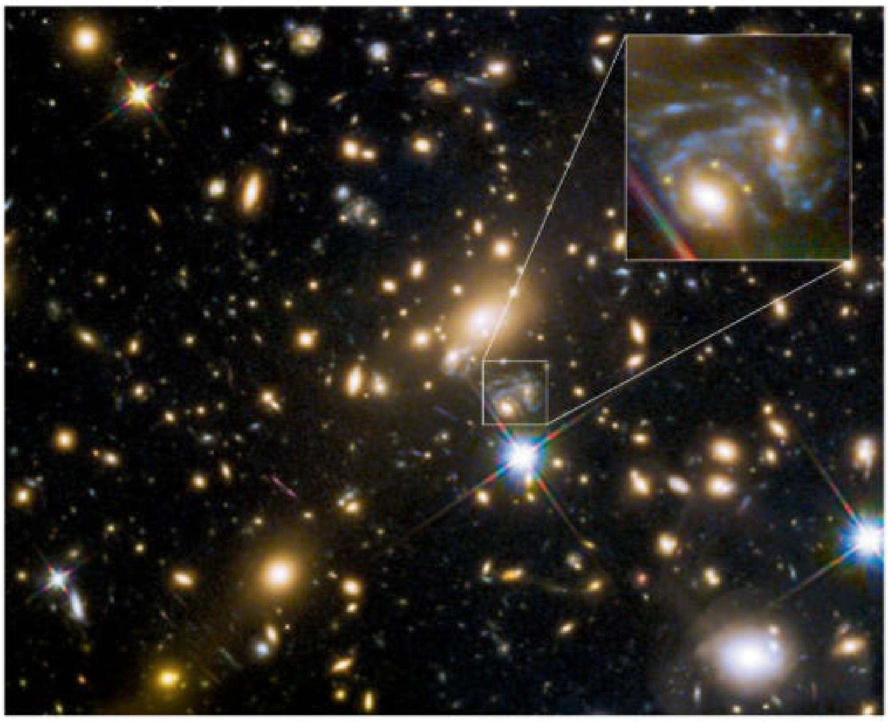
Use of baby kangaroo faeces alone didn't result in reduction of methanogens. However, the researchers found that adding a chemical that inhibits methanogens allowed the acetic acid-producing bacteria to outcompete the other bacteria. Over a 12-day test period, the artificial rumen didn't produce any methane (*Biocatalysis and Agricultural Biotechnology*, doi.org/grr82n).

Ahring now wants to investigate doing faecal microbiota transplants with live animals to see if the technique works outside the lab.

Space

Odd supernova defies our understanding of the cosmos

Leah Crane


NASA/ESA/STSCI

Four images of supernova Refsdal appear around a galaxy cluster as yellow dots

A DISTANT supernova has been used to measure the expansion of the universe, and the result adds an unexpected twist to a long-standing tension.

The supernova was spotted through a quirk of a phenomenon called gravitational lensing. This occurs when the light from a distant object is bent and warped by the gravity of a massive and relatively nearby object. It can result in several images of the distant object appearing around the nearer one, similar to the patterns you might see when looking through a warped lens, such as the bottom of a water glass.

Because the light from the background object takes a different path to form each image, those images can appear to us at different times.

Patrick Kelly at the University of Minnesota and his colleagues have used this strange effect to calculate the Hubble constant, a measure of the universe's rate of expansion. They did so with the light from supernova Refsdal, which is gravitationally lensed by a nearby galaxy cluster.

Refsdal was first discovered in 2014, and a new image of it was captured in 2015, allowing the researchers to use the time delay between the images to calculate the rate at which the universe's expansion is carrying the supernova away from Earth.

There are two main ways of measuring the Hubble constant. The first, called the cosmic distance ladder, relies on measurements of relatively nearby objects to determine how fast they are moving away from Earth.

> "If the value of the Hubble constant is 73, there is something faulty in our models of the universe"

The second uses observations of the cosmic microwave background (CMB), which is relic light left over from the big bang, so the measurements of it need to be extrapolated forwards in time using cosmologists' best models of the universe.

The two methods have disagreed for decades, in what is called the Hubble tension: the distance ladder results in a Hubble constant of 73 kilometres per second per megaparsec (km/sec/mpc), and the CMB method gives a value of about 67 km/sec/mpc.

Physicists have long hoped that independent methods could resolve this tension, but haven't been successful yet.

The new measurement using Refsdal gives a value of about 67 km/sec/mpc (*Science*, doi.org/j9mr). This agrees with the CMB method despite being based on observations of an individual object like the distance ladder method.

The new result doesn't rule out the higher value, but it does mean that the models used to study gravitationally lensed objects hang in the balance. "If the value of the Hubble constant turns out to be 73 like the local measurements would indicate at the moment, then there has to be something faulty in our understanding of galaxy cluster lenses, and these models are used routinely to study the distant universe," says Kelly.

The researchers are now looking at other lensed supernovae to see if they can get more measurements using this method, and other teams are hard at work with other independent ways of measuring the Hubble constant.

If the researchers don't find a way to make the measurements agree with one another, we may need new models of exotic physics to explain what is really going on.

Health

Having naturally high vitamin D levels may protect against psoriasis

Clare Wilson

PEOPLE who are genetically predisposed to have higher vitamin D levels may be less likely to develop psoriasis, an autoimmune condition involving inflamed and itchy skin. Until now, a similar link had only been seen between these gene variants and multiple sclerosis (MS), another autoimmune condition.

In many countries, people are advised to take vitamin D supplements, especially if they get little sun exposure, because the vitamin is made by skin cells in response to ultraviolet light.

There have been many claims about vitamin D's health benefits, some of which have been disproved. For instance, the belief that it can protect against cancer, heart disease and respiratory infections isn't supported by randomised trials of supplements.

"Vitamin D has been proposed to have effects on everything," says Stephen Burgess at the University of Cambridge.

Now, Burgess's team has used a different kind of study to investigate vitamin D's potential benefits against autoimmune conditions. Called Mendelian randomisation, it uses random genetic variation in people's natural vitamin D levels to stand in for the randomisation process used in trials of supplements, for example if participants are randomly assigned to take vitamin D or a placebo.

There are at least four sites in our DNA where different genetic variants influence people's natural vitamin D levels. The team looked at genetic data on these variants and health records from more than 300,000 participants in the UK Biobank, a study that analysed people's DNA and health.

The team matched gene data to whether participants had been diagnosed with any of 28 autoimmune conditions. This showed that being genetically predisposed to having higher vitamin D levels was linked with a lower risk of psoriasis.

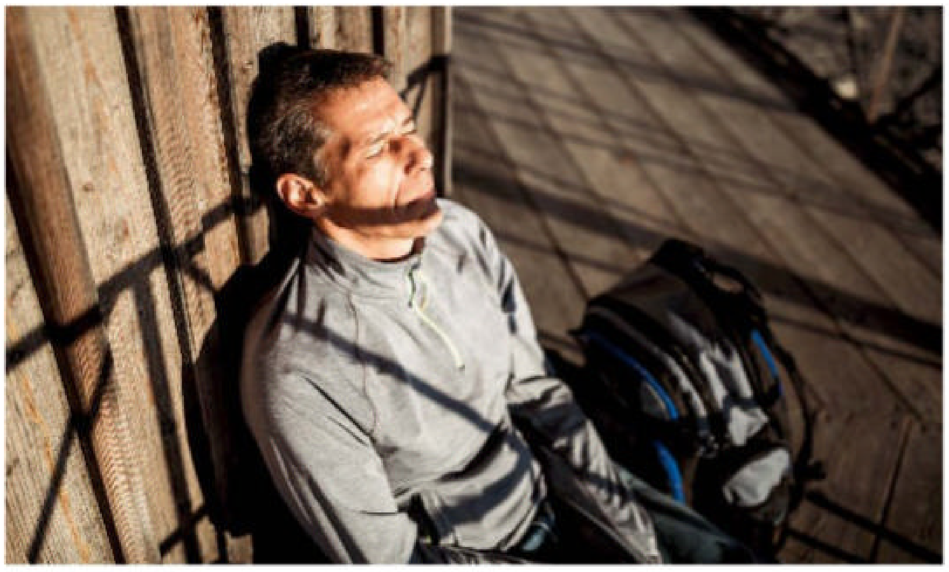
Backing up a previous Mendelian randomisation study, the team also found that being genetically predisposed to having higher vitamin D levels is linked to a lower risk of MS, in which the immune system attacks nerves and causes weakness and paralysis (medRxiv, doi.org/j9gn).

But the vitamin doesn't seem to protect against other autoimmune conditions, such as rheumatoid arthritis. This may be because some conditions are driven by different branches of the immune system, says team member Sizheng Steven Zhao at the University of Manchester, UK.

A randomised trial recently found that in people over 50, taking vitamin D supplements lowers the risk of developing a new autoimmune condition, but it wasn't large enough to show whether the effect applied to all autoimmune conditions or just some. The new study suggests the latter, says Zhao.

Guillame Butler-Laporte at McGill University in Montreal, Canada, says we now need a randomised trial to see if vitamin D supplements can reduce the incidence of psoriasis. ■

Skin cells make vitamin D when hit by ultraviolet light from the sun


JACQUELINE ANDERS/GETTY IMAGES

Space

Saturn usurps Jupiter's crown as host of most moons

SATURN officially has more moons than any other planet in the solar system. The International Astronomical Union (IAU) has announced that the ringed planet has 145 natural satellites versus Jupiter's 95.

As the solar system's most massive planets, Saturn and Jupiter have enough gravitational pull to pluck space rocks from their orbit around the sun. These captured satellites, termed irregular moons, often have strange, widely looping orbits and astronomers are still discovering new ones.

In 2021, Edward Ashton at the University of British Columbia in Canada and his colleagues looked around Saturn for every object larger than 3 kilometres across, and spotted about 150 that seemed to be irregular moons. They also found that many of these moons orbit in the opposite direction to Saturn's rotation and are clumped together, suggesting that many come from a recent collision, or collisions, with some of Saturn's larger moons.

Ashton and his team submitted their findings to the IAU's Minor Planet Center, which has the last word on orbiting bodies. Since 5 May, it has confirmed 62 new natural satellites around Saturn, which brings the total from 83 to 145, besting Jupiter's 95. More may be announced, says Ashton.

Some astronomers take issue with the IAU lumping together very large bodies, like Jupiter's moon Ganymede – which at 5000 kilometres wide is larger than the planet Mercury – with objects that are just a few kilometres across. There could be hundreds of moons below this low threshold around both Jupiter and Saturn, so the one with the most isn't settled yet.

"Jupiter and Saturn are so dominant, mass-wise, that it feels like it's the kind of thing where we're just going to keep finding new moons as telescopes get better and software gets better," says David Brown at the University of Warwick, UK. ■

Alex Wilkins

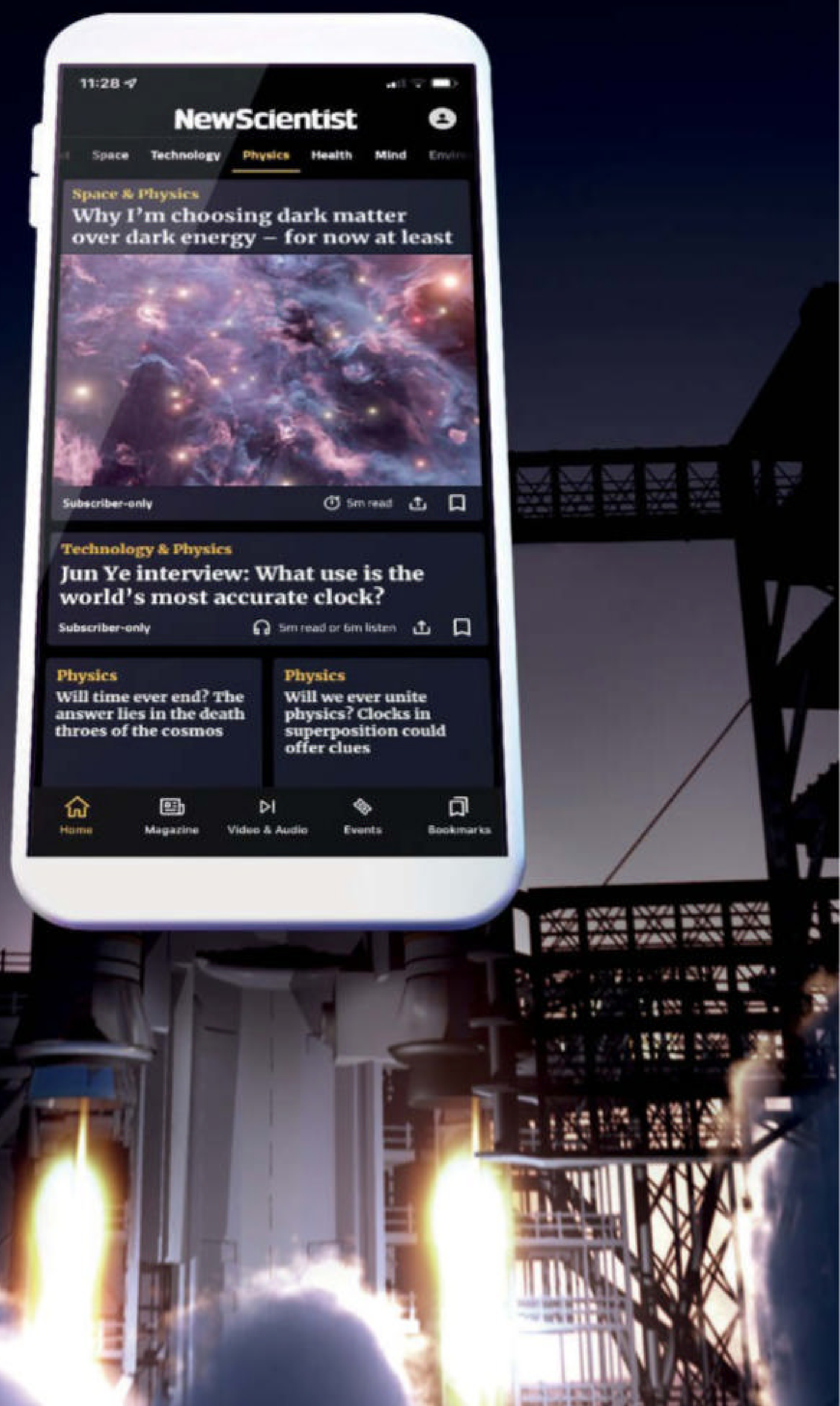
"Jupiter and Saturn are so dominant, mass-wise, that we're just going to keep finding new moons"

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Environment

Dozens of "frost quakes" hit town

TALVIKANGAS in Finland was hit by 26 "frost quakes" in just 7 hours in January, in what is thought to be the highest concentration of the phenomenon ever seen. The seismic activity was recorded by Jarkko Okkonen at the Geological Survey of Finland and his colleagues, who presented the findings at the April meeting of the European Geosciences Union.

Frost quakes – also known as ice quakes or cryoseisms – occur when a temperature rise makes snow melt, saturating soils with water. If temperatures dip rapidly, the water in the ground refreezes and expands, causing ruptures.

The high number of quakes in such a short time lends weight to fears that frost quakes are becoming more frequent in Arctic and sub-Arctic regions as these areas get warmer. **Madeleine Cuff**



DR. FERNANDO ELORRIAGA-VERPLANCKEN

Space

The biggest cosmic explosion ever seen

A SUPERMASSIVE black hole seems to be devouring a huge cloud of gas, producing an explosion the likes of which we have never seen before. So far, it has released about 100 times the total energy the sun will release in its entire lifetime.

Philip Wiseman at the University of Southampton in the UK and his colleagues have been observing this gigantic inferno, called AT2021lwx, and have found that the only cosmic objects brighter than it are quasars, which are caused by a continuous flow of gas into a supermassive black hole (*Monthly Notices of the Royal Astronomical Society*, doi.org/gr75b8).

AT2021lwx is probably a supermassive black hole devouring a cloud of gas that is at least 100 times bigger than the solar system, they say. **Leah Crane**

Zoology

Seals in the Pacific are experiencing fur loss

SOME fur seals in the Pacific Ocean are losing their fur, and dietary changes brought on by climate change may be responsible.

Alopecia, a condition that involves the loss of hair, can affect the ability of these animals to keep warm, says Karina Acevedo-Whitehouse at the University of Queretaro in Mexico. "Fur seals rely heavily on their double layer of fur in order to achieve adequate thermal insulation,"

She and her colleagues collected fur samples from 13 Guadalupe fur seals (*Arctocephalus townsendi*) in the San Benito archipelago off the west coast of Mexico between 2017 and 2018.

The team analysed these using scanning electron microscopy and X-ray spectroscopy to determine how healthy the hair follicles were.

Nine of the seals showed visible signs of alopecia, but all had unusually brittle hair. "This suggests that the changes are gradual and this alopecia only appears after the fur has undergone extensive structural damage," says Acevedo-Whitehouse.

Microscopic analysis of the hairs ruled out the presence of bacteria, fungi, mites or lice, which are all possible causes of alopecia. There were also no signs of inflammation or lesions on the underlying skin that are often seen in viral infections (bioRxiv, doi.org/j9k5).

The gradual change in the hair structure suggests that nutritional deficiencies are behind the hair loss, says Acevedo-Whitehouse.

Sea surface temperatures in the area have risen in the past few years and may mean preferred species of fish and squid prey are less available to the seals, she says. **Jason Arunn Murugesu**

Really brief



SHUTTERSTOCK/RIMMA BONDARENKO

Salty snacks may test better with cola

Phosphoric acid – found in cola – seems to open the sodium channels on our tongue, allowing us to better taste salty flavours in snacks like pretzels and crisps. Adding the acid to foods might let firms use less salt, cutting the risk of high blood pressure, which can lead to heart attacks (bioRxiv, doi.org/j9kz).

Hammerheads hold their breath to dive

Scalloped hammerhead sharks clamp their gills shut when they dive into cold, deep water hunting for squid. By closing their blood-rich gills as they rocket downwards at an 80-degree angle, they may keep warm, effectively sidestepping their cold-blooded biology (*Science*, doi.org/gr743j).

Face mask lets you detect odours in VR

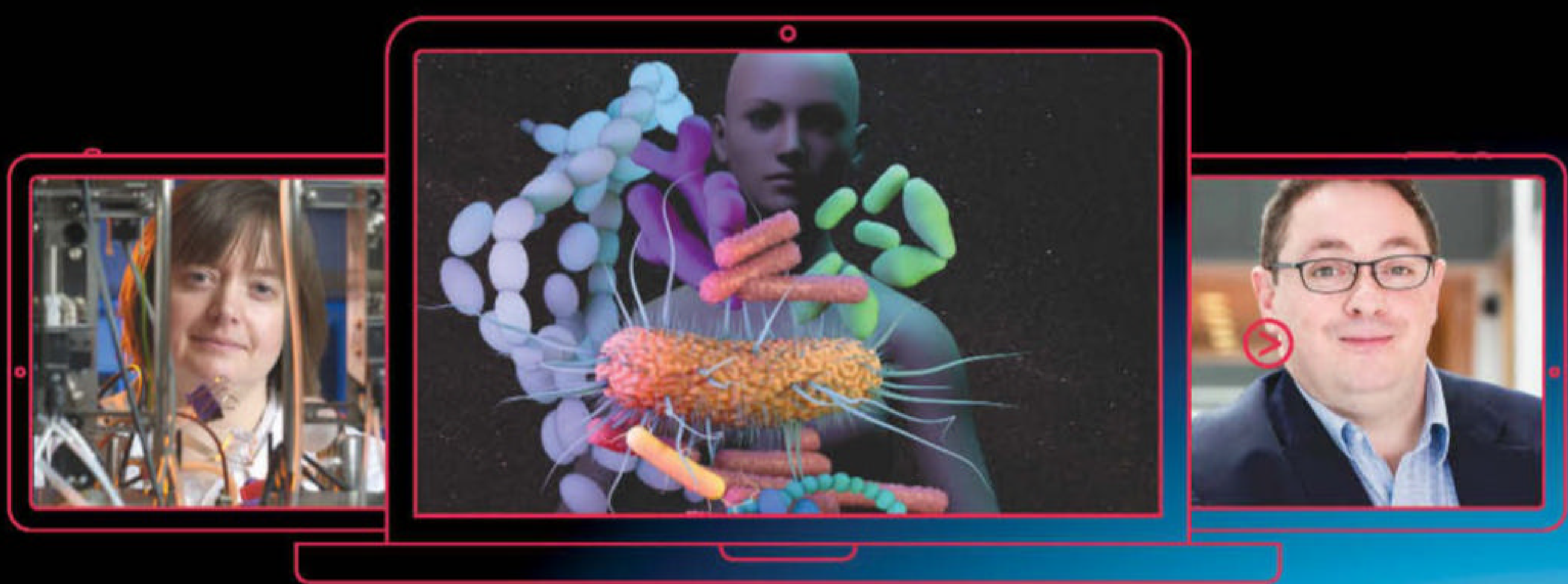
A face mask designed for use in virtual reality can release smells to enhance a simulation. Volunteers trying it could detect odours including lavender and mint with an average success rate of 93 per cent. It could be used to mimic the odour of specific people (*Nature Communications*, doi.org/gr7xsk).

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Comment

Talking horse sense

When it comes to equine sports, animal rights protesters need to base their efforts on science, not emotions, says **Christa Lesté-Lasserre**

HILL SIXTEEN broke his neck falling at the first fence of this year's Grand National race at Aintree in the UK. Animal rights activists say the 10-year-old Thoroughbred would still be alive today if he hadn't been forced to race over the jumps. The horse's trainer blames the death on animal rights activists – the very ones hoping to protect horses as they rushed onto the track just before the race started, triggering a huge police response.

This chaotic scene is emblematic of the greater problem facing horse sports: they are losing the approval of a well-meaning but underinformed public. If the activists had known more about horse behaviour, they might have opted for protests that wouldn't stress out these animals, high-strung Thoroughbreds set to run the most challenging course of their careers.



SIMONE ROTELLA

Animal rights activists fill an important role speaking out for voiceless fellow species that become victims of human mistreatment. But we urgently need their efforts to be based on science, rather than on passions, emotions or anthropomorphism. Social media has become a powerful outlet for some activists to spread propaganda that isn't necessarily grounded in either truth or science. This fuels fires that risk doing little service to the animals they want to protect.

The mink fur industry, for example, is gradually losing its "social licence to operate", as public support wanes and people call for more bans. But those who release farmed minks into the wild to "save" them create health and welfare nightmares for both the freed mink and local wildlife.

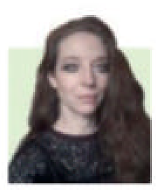
In the sports world, greyhound racing has lost its social licence to operate in all but a few areas. In some places, large-scale track closures have led to a sudden need to rehome thousands of dogs bred for speed rather than walks in the park. While that might seem like a short-term problem for a long-term good, it would be better to let these animals do what they love – run fast – in ideal welfare conditions backed by science.

Fearing its own social licence is next on the list, the Fédération Equestre Internationale (FEI), based in Lausanne, Switzerland, which oversees all the Olympic disciplines of horse sport except the modern pentathlon, has brought in top welfare scientists as external advisors. Together, they are working hard to improve the image of these sports and justify their existence.

That is happening none too soon, as the International Olympic Committee (IOC) is receiving multiple demands from activist groups to ban any sports involving animals – especially since the media storm surrounding the horse Saint Boy, the showjumper punched by a German coach during the modern pentathlon in Tokyo. The governing body that oversees the pentathlon horses has opted to remove animals totally from its sport after the 2024 games, replacing them with an obstacle event. It seems to prefer this than deal with public criticism.

The FEI has no plans to pull horses from any of the Olympic disciplines it covers, and the IOC says it doesn't, either. On the contrary, it has "full confidence in the FEI in guaranteeing the highest levels of horse welfare for the Olympic Games Paris 2024", a spokesperson tells me.

It is right to take this view, as the FEI's welfare science team is investigating the way these horses live and train and making evidence-based recommendations for improvement. It aims to ensure each equine lives a "good life" tailored to the emotional and physical needs of domestic horses bred to work side by side with caring humans. That is the kind of "activism", grounded in science, these animals really need. If the public can trust the science – and if governing bodies act on evidence-based recommendations – it will be a win for all. ▮



Christa Lesté-Lasserre is a science writer based in Paris, France

Our Human Story

What does the fox say?

We used to think "synanthropic" animals like foxes started living alongside us around 10,000 years ago. But it could have been much earlier, says **Michael Marshall**



Michael Marshall is a science writer based in Devon, UK. He writes *New Scientist*'s monthly email newsletter about human evolution, Our Human Story. His book *The Genesis Quest* is about the origin of life on Earth and is now available in paperback.

Mike's week

What I'm reading

The Song Rising, *the third of Samantha Shannon's twisty urban fantasies set in a totalitarian London.*

What I'm watching

Everyone says Top Gun: Maverick *is a masterpiece of escapist cinema, but no film that wastes Jennifer Connelly is a masterpiece.*

What I'm working on

In order to remind you all that the life of a reporter is one of glamour, I'm researching sewage.

This column appears monthly. Up next week: Chanda Prescod-Weinstein

STATISTICALLY, you probably live in a city. Around 55 per cent of humans do, and in high-income countries where *New Scientist* has most of its audience, the figures are even higher.

This means you also live alongside urban animals. In the UK, where I live, the most conspicuous ones are pigeons, foxes and gulls. These species have adapted to life alongside us, often by eating the food we throw away.

Animals such as urban foxes that live alongside us, and benefit from doing so, are called synanthropes. They aren't domesticated like dogs or cows, but they are adapted to a human-centric life. Some urban foxes have skull shapes that differ from country-dwellers and more closely match domesticated dogs. Other examples include rats and trash pandas – sorry, I mean raccoons.

It is generally thought that synanthropy began with the agricultural revolution, around 10,000 years ago. That is when people started settling down in the same place instead of moving around, and crucially when they started storing large quantities of food and accumulating rubbish.

However, it now looks like synanthropy may go back several tens of thousands of years, and other hominins like Neanderthals might have had their own synanthropic companions.

Very little research has explored the idea of synanthropic animals before the rise of agriculture, so what follows is tentative. It is based largely on the work of Chris Baumann at the University of Helsinki in Finland, who published a review in April summarising what is known.

Baumann says archaeologists have assumed for decades that animals couldn't form synanthropic associations with hunter-gatherer communities. Without permanent settlements with waste food and refuse heaps, how would synanthropic animals support themselves?

However, hunter-gatherers on the go could provide a niche for animals if they produced enough waste. The evidence for this all comes from Europe. In a 2020 paper, Baumann showed foxes in south-west Germany began eating a more restricted diet dominated by reindeer around 42,000 years ago – not long after modern humans arrived in the area.

Similarly, in the Czech Republic there are a number of mammoth kill sites where tons of mammoth bones from between 30,000 and 25,000 years ago are preserved. Raven bones at the sites contain telltale chemicals, revealing that they ate a lot of mammoth.

> "In some of the sites, people collected fox teeth and raven feathers, suggesting that they valued the animals' presence"

"When humans hunt large herbivores there's a lot of waste," says Baumann. "They will not eat everything." It seems the foxes and ravens got the scraps.

Why did early Europeans tolerate foxes and ravens eating their leftovers? Baumann points out they didn't pose a threat, so there was little incentive to drive them off. Furthermore, by eating the scraps, the foxes and ravens may have reduced the incentives for larger carnivores like wolves to come scavenging, which would have threatened the humans.

In some of the sites, people collected fox teeth and raven feathers, perhaps for clothing or jewellery – suggesting that they valued the animals' presence.

How widespread were these palaeo-synanthropies? The short answer is we don't know. The European evidence is limited to just part of the continent and the last 42,000 years, where studies have been done. Baumann suspects palaeo-synanthropies were older and more widespread, but he needs direct evidence.

Conceivably, only modern humans changed their local environments enough to attract animals like foxes. In that case, the interaction may have developed in Africa and then spread to other continents when our species did.

Alternatively, synanthropies may have formed whenever hominins had a large ecological footprint. Baumann has plans to explore sites in France that were heavily used by Neanderthals, and which also have the remains of foxes and ravens.

Without more information, it is hard to say what this means for the origins of domesticated species. Baumann says some animals may have become domesticated this way, such as cats, who preyed on the mice eating our grain. In contrast, livestock animals like cows were probably deliberately corralled by humans. He also doubts wolves could have been domesticated into dogs through synanthropy, because wild wolves posed a real threat to Stone Age people.

Synanthropic species occupy a nebulous position today. Many of us perceive them as pests, but maybe the knowledge of palaeo-synanthropies will help us get a bit of perspective. Our relationship with foxes, we now know, goes back at least 40,000 years – four times as long as we have had domesticated cats, livestock and crops. Maybe we could, at some point, get used to them. ■

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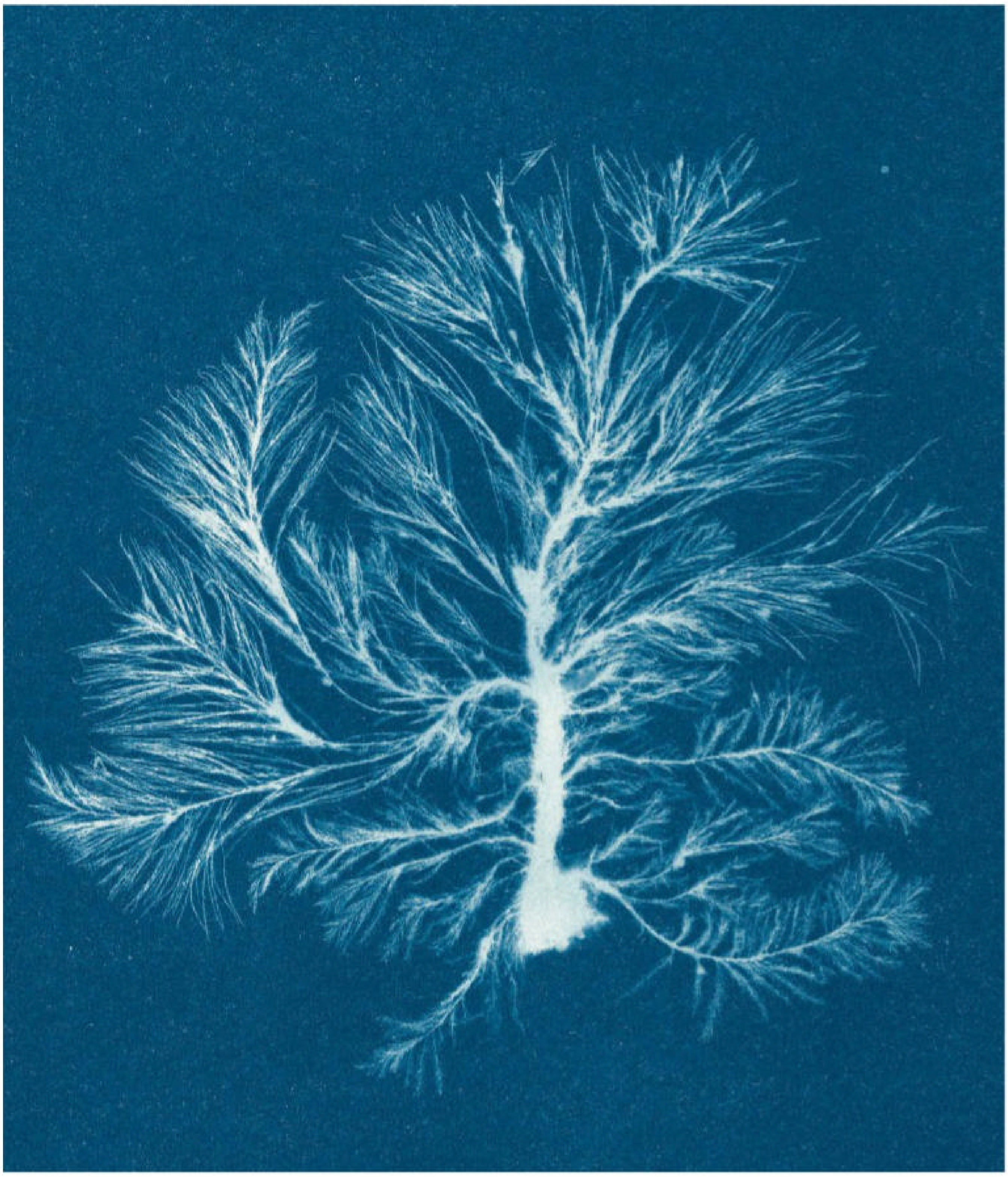
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Algal blooms

Publisher Taschen

THESE beautifully detailed images show the remarkable legacy of Anna Atkins, a 19th-century botanist who left her stamp on science and photography with her signature "cyanotype" prints.

The selection is taken from a new book by Peter Walther, *Anna Atkins. Cyanotypes*, which reveals the ingenuity of Atkins, who used cyanotypes as a medium for documenting plants and algae. Her images had an unprecedented clarity and accuracy, and were produced by placing specimens onto paper coated with a light-sensitive iron salt solution. The paper was then exposed to sunlight and washed with water to fix the image.

Atkins published *Photographs of British Algae: Cyanotype Impressions* in 1843 – the first time a book was illustrated with photographs. She published three volumes in total, of which only a handful of copies are known to exist today in museums, libraries and galleries around the world.

Anna Atkins. Cyanotypes collates more than 550 of her iconic images, which, along with representing "milestones in the history of science and media", writes Walther, are also special due to the "timeless aesthetic appeal" of the intricate specimens contrasted against blue.

On the far left is the algae *Dasya coccinea*, originally pictured in *Photographs of British Algae Volume II*. The larger of the images to its right is *Sphacelaria scoparia*. From left to right, the smaller images show *Lastrea foenisecii*, a fern from Atkins's *Cyanotypes of British and Foreign Ferns*, followed by two algae species, *Rhodomenia polycarpa* and *Conferva gracilis*, which featured in *Photographs of British Algae Volume III*.

Gege Li

Editor's pick

More views on how to handle AI's sudden rise

22 April, p 12

From Steve Willmott, Chandler's Ford, Hampshire, UK

The rising interest in and concern about artificial intelligence is being fuelled by advances in computing techniques and an increase in the abundance of information available to AIs. Computers are spectacularly good at well-defined tasks and this seduces people into thinking that technology is overreaching itself.

Essays, job applications, TV scripts etc. are being synthesised through ever more sophisticated pattern matching of keywords and phrases with the huge amount of text available online. My concern is that this doesn't generate new information. It simply repeats what has already been written. New problems and challenges need new ideas. Existing thinking is at risk of becoming entrenched.

From Fred Zemke, Grover Beach, California, US

Some common questions about AI programs are whether they have attained consciousness or general intelligence. I suggest that these may be the wrong questions. Instead, I ask whether these programs have drive: the drive to survive, grow and reproduce.

All biological organisms have drive, even without consciousness or general intelligence. At present, I don't know of any AI program with drive, but it is certainly conceivable. Consider the following example: a computer virus with AI capabilities. It can reproduce by disseminating copies of itself across the internet, and those copies can become "mutated" (different to their parent) if the AI is clever enough to write its own code. At this point, the forces of evolution can take over. The computer virus inhabits an ecological niche – the address space of a computer attached to the internet – and it becomes engaged in a life-or-death struggle with antivirus software, thereby evolving a drive to spread across computers while evading and outwitting the antivirus.

From Paul Massie, Half Moon Bay, California, US

Computer science has been my profession for more than 40 years, so I know the field, including AI, relatively well. Concerns about bias and a Terminator-style extinction event seem largely to be red herrings. The true threat that AI poses is the destruction of jobs. AI doesn't need general intelligence to do your job better than you do. Also, it doesn't need to kill all humans to destroy society – all it needs to do is eliminate most of the jobs.

Our society is based on the principle that people work for money, which they use to buy things and pay taxes. What will be left of society if most people can't get money by working? I invite those sceptical of this to look at the status of the board games chess and Go. Humans are no longer competitive against AIs in those games. Journalism and coding are under threat today.

From John Spivey, Thorverton, Devon, UK

The discussion of the latest advances in AI brings to mind the 1954 short story *Answer* by Fredric Brown, in which a computer is asked if there is a god. It answers by saying "now there is" and permanently fuses its switch into the on position.

From John Cherian, Petaling Jaya, Malaysia

To avoid AI pitfalls, we need regulators to limit access to this new technology to those who are trained and appointed to use it.

Returned to natural state, bland river is now a joy

29 April, p 42

From Pamela Ross, Findochty, Moray, UK

Thank you for Graham Lawton's very interesting article on restoring rivers to their natural states. As a child, I would regularly visit my grandparents who lived in an industrialised area of Germany, where I would walk past the canalised stream running through their suburb. It was bland, with concrete sides, and just served the purpose of moving water rapidly. There wasn't much to see.

More recently, that stream (the Rüpingsbach) has been "re-natured" as part of a wider scheme for local water courses and wastewater. It is amazing the difference this has made: it is now surrounded by plants, trees and wildlife, with all the benefits attached to that transformation.

Curing ageing raises so many tricky questions

29 April, p 36

From Robert Checchio, Dunellen, New Jersey, US

In addition to the points raised by Sandrine Ceurstemont in her review of a podcast about heading off ageing, dramatically extending our lifetimes increases how long our financial resources must last and raises many more dilemmas.

Will remaining physically young translate to our mental state? Will people be expected to work decades longer? If so, what effect will that have on the ability of young people to find jobs? Perhaps more importantly, could a few powerful governments obtain control of the technology and decide for themselves who can live longer?

There is no legal green light for new UK oil field

6 May, p 28

From Tessa Khan, climate lawyer and executive director of Uplift, UK

You state that the UK government is "legally bound" to allow the development of the Rosebank oilfield due to it being a signatory to the Energy Charter Treaty.

While the licence to explore for Rosebank's oil was issued in 2001, the holders aren't permitted to extract the oil until they get a development permit. That can only occur after the field passes several regulatory hurdles, including an environmental impact assessment. If it fails to surmount these, the field will be rejected – as other oil and gas fields have been in the past – without triggering liability under the Energy Charter Treaty. The relevant minister also has a discretionary power to direct the regulators in matters that are in the public interest.

These points were tested in 2021, when the UK government wrongly claimed that its hands were tied over the Cambo oil field and that ministers couldn't block approval. It conceded this wasn't the case after getting a legal letter from climate groups Uplift and Friends of the Earth Scotland.

Books play second fiddle to screen time these days

22 April, p 42

From John Howes, Cardiff, UK

It is no mystery why children's reading skills are diminishing – they have their noses in iPads and iPhones 24/7.

Conspiracy theories: Fight fire with fire

15 April, p 12

From John Dodson, Sydney, Australia

Can conspiracy theories be stopped? Yes, by implanting chips in the promulgators that prevent them making promulgations.

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Living for the drama

When we call someone a "drama queen", are we describing a personality type or something more serious? It is a question worth exploring, finds **Elle Hunt**



JUSTIN LAMBERT/GETTY IMAGES

Book
Addicted to Drama
Scott Lyons
Hachette

MOST of us know people who we might describe as being "addicted" to drama. They are the ones who cause chaos wherever they go, and for whom inconveniences register as crises. They may be the friends who shine at a dinner party – or the colleagues you give a wide berth at the water cooler. Either way, they end up looming large in our lives as their theatrics emanate outwards, roping us in as players on their stage.

As instantly recognisable as this personality type may be, it isn't often described or discussed – at least not beyond the level of the individual in any scientific sense. But, as clinical psychologist Scott Lyons points out, the world is awash with drama. This comes in many forms, real and contrived, from social media priming us to narrate our lives to reality TV scripting narratives from daily life.

At the heart of Lyons's new book, *Addicted to Drama: Healing dependency on crisis and chaos in yourself and others,* is whether so-called addiction to drama is an individual predilection, a pathology or a society-wide concern.

Some individuals, Lyons argues, learned in childhood that the only way to get attention or intimacy was to sweep others up in a whirlwind of their own creation – an instinct amplified by the modern world. The subject is close to his heart, as a self-described reformed "drama queen".

Lyons describes how he grew up with inconsistent care from his parents and internalised the message that he was only deserving of love when he was in the spotlight. This was exacerbated by bullying at school about his sexuality and learning disability to such an extent that, by the age of 13, Lyons ended up in hospital with mental health problems. In adulthood, he sought out ways to make drama central to his life by working in the performing arts.

> "Behaviours that might be dismissed as attention-seeking are shown to be coping mechanisms"

Even city living was conducive to a fast pace and high stakes. "I always thought that I was good at handling stress," Lyons writes. "What I didn't realise was that I was using it to thrive." Many of us may be doing the same thing, he suggests. After all, nearly everyone "can identify others as addicted to drama, and yet few identify themselves as such", he writes.

As works of popular psychology go, *Addicted to Drama* falls somewhere between a big-ideas book and a self-help manual, with its split between cultural analysis and individual solutions. Lyons's reliance on qualitative evidence and composite case studies limits the book's credibility as a work of serious science.

So, too, does the somewhat nebulous concept of "drama" itself, which Lyons is content to leave loosely defined, using it to describe everything from the feeling of exhilaration during a thunderstorm to communication problems in relationships. Even his premise that such an "addiction" is consistent enough to be described – or, indeed, possible – may be a bridge too far for some readers.

But the personality type that Lyons outlines is certainly familiar, perhaps increasingly so, and the links he draws with our "urgent, go-go-go culture and always-on-display social media world" are fresh, persuasive and compelling.

These connections between the individual and the big picture enhance Lyons's argument – but it is truly elevated by his compassion, no doubt informed by his personal experience. If you have ever found yourself fascinated by someone's seemingly limitless self-absorption, as displayed on your Twitter feed or at a professional networking event, *Addicted to Drama* might present another, more sympathetic view.

Those who thrive on drama may be reacting to forces like social media

Behaviours that might easily be dismissed as attention-seeking, or even narcissistic, Lyons shows to be coping mechanisms and cries for help, invariably dating back to childhood neglect or past trauma. In parallel, over the past 15 years or so, the idea of "the self" has become central to our society, with a digital economy built on attracting and holding the attention of others.

It is easy to feel exasperated by people who are forever lighting fires in order to put them out, but Lyons points to a world that is soaked in petrol. At least he hands us a fire extinguisher. ■

Elle Hunt is a writer based in Norfolk, UK

Bringing it all together

An enticing new wing of New York's natural history museum aims to connect living things. It is a triumph, says **Alexis Wnuk**

Museum
The Gilder Center, New York
Studio Gang Architects
Open now

FROM the outside, the Gilder Center beckons. Its curved windows resemble the entrance to a cave, and suddenly I need to know what is inside. That is probably why Jeanne Gang, whose firm designed the centre, calls it an "innie" building – it invites you in.

Inside, I feel an itch to move and explore. The cavernous atrium feels like a canyon that has been weathered over millennia, with water and wind carving windows and passageways through the rock. The windows tease with glimpses of new exhibits – like the insectarium to my left – and the floors above.

The Richard Gilder Center for Science, Education, and Innovation is an addition to the American Museum of Natural History in New York. It is all about connections. In the literal sense, by linking to 10 buildings on the museum campus at 33 different points, eliminating dead ends and improving visitor circulation. But it also aspires to show how all life is connected.

My first stop is the Collections Core. The floor-to-ceiling glass cases house more than 3000 items, from fish made transparent for easier study to Maya bricks and an impressive collection of megalodon teeth. The cases provide a sense of the sheer size of the Collections Core, which has about 4 million items in total. They also allow visitors to see real scientists at work, as they retrieve and study the samples. It is an important reminder that museums are active environments, not collections of long-forgotten artefacts.

Another good example of how the Gilder Center makes the natural world come alive is in the insectarium, the museum's first area devoted to insects in more than 50 years. The displays were vying for my attention until I saw the real show stealers: half a million leafcutter ants diligently ferrying bits of leaves and flowers, oblivious to my existence. Transfixed, I watched them traverse a maze of planks and a skybridge to reach a wall of glass orbs where they farm fungus – before I realised that I had lost my tour group.

The vivarium was similarly arresting. Aside from the heat and humidity – the space is kept at a balmy 25°C (77°F) and 75 per cent humidity – I could have stayed there for hours after discovering that it is impossible to feel stressed when dozens of butterflies are silently flapping around your head.

The facility is home to almost 1000 butterflies from 130 species, of which about 80 species are on view each day. When you exit, you first enter a mirrored vestibule so you can check that no butterflies are hitching a ride. I will admit I was a little disappointed that none of them considered me a good perch.

Venturing upstairs and across a bridge, I reached Invisible Worlds, an immersive and interactive digital display. Here, images are projected onto the walls and floor of an oval-shaped room. A looped, 12-minute video, with no discernible beginning or end, sets out to expose the connections between life at all scales.

A jungle canopy gives way to flocks of birds in migration, which morph into a visual representation of all the text messages being sent in New York and a map of the subway lines shuttling people around the city. Then we are off on a journey inside the human brain, with its dense forest of billions of neurons. When I step on a grey neuron projected onto the floor, it illuminates neon green and fires off messages. At this point, many of us in the room (all adults representing media outlets) are hopping around in a neural disco.

And that, in the end, is why the Gilder Center is such a triumph. From its exhibits to its architecture, it taps into our innate curiosity and childlike sense of wonder about the world, reminding us that we are just one small part of it.

The atrium of the Gilder Center resembles a canyon that has been weathered over centuries



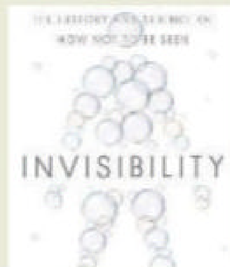
AMERICAN MUSEUM OF NATURAL HISTORY

Don't miss



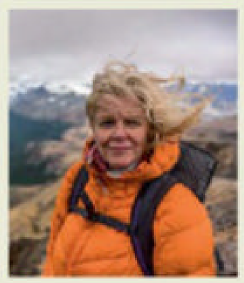
Watch

Nam June Paik: Moon is the oldest TV is a documentary about the experimental artist (pictured) who preferred *Popular Mechanics* to art history, predicted the internet and enabled mass media. In UK cinemas from 19 May.



Read

Invisibility is physicist Gregory J. Gbur's focus, as he traces the dark art of not being seen from early science fiction through modern optical science to a future full of stealth technology and weird materials. On sale now (US); 23 May (UK).



Watch

Wild Life is the story of Kris (pictured) and Doug Tompkins, outdoor-wear pioneers with a plan to conserve nature by buying land in Chile and Argentina, then turning it into national parks. Streaming on Disney+ from 26 May.

JIMMY CHIN, SUNDANCE INSTITUTE

The film column

Tragically common Hang Son Doong, a beautiful and extraordinary cave in one of Vietnam's poorest regions, was all but unknown. Then cavers arrived and opened the way to tourism. **Simon Ings** explores a documentary that exposes the true cost



Simon Ings is a novelist and science writer. Follow him on Instagram at @simon_ings



RYAN DEBOODT

The otherworldly quality of Hang Son Doong

"EVERYONE on a bicycle wants to be on a motorbike. Everyone on a motorbike wants to be in a car. And everyone in a car wants to be in a helicopter," says entrepreneur David English, a wry smile creeping across his face. "So off we go to the future."

Ten years ago, Phong Nha in Quang Binh province was one of the poorest regions in Vietnam. English arrived during flooding in 2010 and remembers the air of despondency. People fished the rivers and grew a little rice. Hunger was commonplace.

But the arrival of a British caving expedition the previous April had signalled a big change. The team had come to explore a remote cave system, whose entrance had been found by a local man named Ho Khanh in 1990, but that had otherwise been ignored.

Following a 5-kilometre-long fault through limestone, the cavers discovered chambers that are each big enough to hold a skyscraper. In places, the ceilings are 200 metres high. Where the roof has fallen in, sunken forests sport rare tree ferns and other plants.

With its jungles, rivers and waterfalls, Hang Son Doong is the largest dry cave (dry because it isn't underwater) in the world. "It doesn't feel like you're on planet Earth any more," says Meredith Harvey, a visitor to the cave.

Now, the local government wants to run a cable car through the site, opening it up to 1000 tourists an hour. Conversations with UNESCO (the cave is in Phong Nha-Ke Bang National Park, which became a UNESCO World Heritage Site in 2003) have won a reprieve until 2030, but no one believes the site will remain untouched forever.

> **"This is a film about a wicked problem, sure to despoil a wonderful location, if not today then tomorrow"**

In *A Crack in the Mountain*, director Alastair Evans tells a story we have heard many times before. It is a "tragedy of the commons", a term coined in 1968 by biologist Garrett Hardin for situations in which people use a shared resource for their own self-interest, leading to its eventual depletion. Will this happen here?

Certainly. It is hard to imagine a rapidly growing economy writing off its most potentially lucrative wonder so a few wealthy tourists can enjoy its pristine charms.

It isn't unreasonable to want an adventure, or to make the most of your birthplace. Nor is it, after a lifetime of riding to work on a motorbike, to want your children to afford a car. It is what makes the tragedy of the commons a tragedy.

Of course, you can still watch the documentary for its beauty, and some credit for this goes to Oxalis Adventure, an expeditions and production company founded by Phong Nha-born entrepreneur Nguyen Chau, which has put a lot of money back into the local economy – and made it possible to film the documentary at all.

The production values of the documentary are extraordinarily high and the cave expeditions appear very well managed. One might wish that Nguyen could simply be left alone to tailor the region's development according to the needs of local people.

But then, that is to forget the ravages of covid-19, which closed down 90 per cent of Phong Nha's small businesses, not to mention recent floods that brought what little activity remained to a standstill.

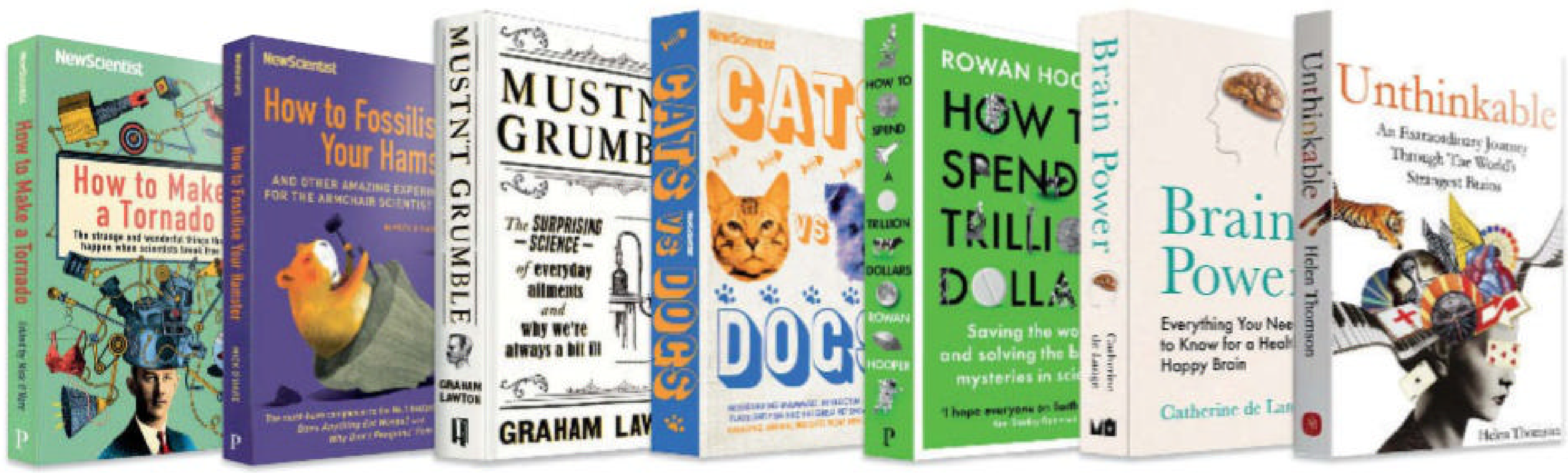
This is a film about a wicked problem, sure to despoil a wonderful location, if not today then tomorrow or the day after that. By then, if a way to solve this impossible equation is to be found, it will surely have been inspired by films as intelligent and passionate as this one. ■

Film
A Crack in the Mountain
Alastair Evans
Selected UK venues from 26 May; US to be announced

Simon also recommends...

Book
Underland: A deep time journey
Robert Macfarlane
Penguin
An excellent 2019 account of subterranean Earth leads readers from Greenland's ice-blue glaciers to rock art in remote Arctic sea caves.

Film
The Land That Time Forgot (1974)
Kevin Connor
On DVD and Blu-ray
Doug McClure and Susan Penhaligon go exploring in this fine piece of hokum.



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Nipping ageing in the bud

Senolytic drugs that promise to "treat" ageing are already being trialled in humans. Can they live up to the hype, asks **Graham Lawton**

I COME from a family with dodgy knees. My dad, 79, has had two complete knee replacements and my sister needs one at the age of just 54. My left knee hurts when I walk downstairs and clicks when I bend it – classic signs of the age-related disease osteoarthritis, caused by wear and tear on the cartilage cushioning the joint.

By the time I get to the knee-replacement stage, however, I might not need to go under the knife. Instead, I hope to be able to swallow a few pills every so often and feel my knee pain disappear.

Osteoarthritis isn't just down to wear and tear, but also an accumulation of some nasty cells, which attack the knee joint from within. They are called senescent cells – old or run-down cells that have reached the end of their lives or suffered irreversible damage. They ought to die and yet they don't, instead lurking in tissue, causing trouble.

Senescent cells are normally cleared out by the immune system, though that goes wrong during ageing and they accumulate, dripping poison into their surroundings and turning other cells rogue. They are a leading cause of numerous age-related conditions, not just in the knees but also in the heart, liver, muscles and brain.

No surprise, then, that researchers have been eyeing senescent cells for many years as a juicy target for efforts to slow, halt or even reverse ageing. Now, we have numerous drugs in the pipeline and some tantalising results from human trials. There is even hope that, by taking out senescent cells, other causes of ageing will evaporate too.

Cell senescence was discovered in 1961 when Leonard Hayflick and Paul Moorhead at the Wistar Institute in Philadelphia, Pennsylvania, discovered that human cells will divide no more than 55 times in cell culture.

This so-called Hayflick limit was later found to be linked to the shortening of telomeres, caps of DNA at the ends of chromosomes that prevent them from falling apart. Each time a cell copies its chromosomes and divides, its telomeres shorten slightly, like a countdown. Once they have worn away completely, the cell either dies or enters a twilight-zone, no longer dividing but still alive. This fate became known as cell senescence.

Senescence was also found to be triggered by external insults too, such as DNA damage from UV radiation or chemicals, physical injuries and attacks by viruses or bacteria.

In 1979, Edward Schneider, then at the US National Institute on Aging in Baltimore, Maryland, discovered that senescent cells are present in living humans and become more abundant with age. Other researchers linked senescent cells with various age-related conditions, including Alzheimer's disease, osteoporosis, diabetes, liver cirrhosis and renal and cardiovascular disease.

Another key breakthrough came in 2004, when a team led by Janakiraman Krishnamurthy at the University of North Carolina in Chapel Hill showed that senescent cells accumulate more slowly in calorie-restricted mice, which are known to live longer. It looked as though senescent cells were both ›



SOFIA IVA

a cause of ageing and an interesting target for anti-ageing treatments. That prompted James Kirkland at the Mayo Clinic in Rochester, Minnesota, to hypothesise that destroying senescent cells may be a route to rejuvenation.

Potent cocktail

Senescence was initially (and correctly) assumed to have evolved as an intrinsic defence against cancer: if old or damaged cells can no longer replicate, they can't proliferate uncontrollably. But it was a mystery why they didn't just activate a type of programmed cell death called apoptosis. The answer turned out to be that – in people roughly under 50 at least – senescent cells play a key role in the repair of damaged tissues. They enter this zombie-like state to take one last hit for the team, calling in an immune response that kills them and cleans up wider damage to the tissue, clearing the way for replacement by new cells.

This process is initiated by the senescent cells secreting a complex cocktail of signalling molecules, which mobilises nearby immune cells and promotes inflammation. This potent stew is called the senescence-associated secretory phenotype (SASP).

As we get older, however, this process gradually diminishes and eventually backfires. As more and more cells reach the Hayflick limit or get damaged and enter senescence – including the immune cells that perform the clean-up – the sheer quantity of senescent cells overwhelms the body's ability to clear them out and they accumulate. "They just sit there making a nuisance of themselves," says Linda Partridge at the Max Planck Institute for Biology of Ageing in Cologne, Germany.

That is bad news because compounds in the SASP are toxic to healthy tissues. Left lingering inside cells, they induce DNA damage, mitochondrial dysfunction, the slowdown of processes that normally recycle bits of old cells and a host of other troubles. Outside cells, they cause prolonged inflammation and the overproduction of proteins that lead to a type of thickening of tissue in various organs, called fibrosis.

Cells damaged by the SASP often turn senescent themselves, so senescence creeps throughout the body with age. This is what Kirkland calls the threshold theory of senescent cell burden – once senescent cells exceed a certain level, they start to self-amplify. The SASP's reach also travels far and wide via the bloodstream. And the longer the cells persist, the more toxic they become. "They start having mutations after a month or two and the SASP gets more and more damaging over time," says Kirkland.

Indeed, the SASP is so toxic that it only takes a small dose of senescent cells to cause trouble. In a 2018 study, Kirkland's team took young, healthy mice and transplanted a million senescent cells into each of them, giving them an overall senescent cell burden of 1 per 10,000 cells. The mice aged and died prematurely, of the same age-related conditions that kill naturally aged mice. The transplanted cells didn't move far from where they were injected into the abdominal cavity, but senescent cells showed up in the limbs of the mice, confirming that the SASP can act at long distances.

Recall that one of the key features of senescent cells is that they have switched off apoptosis. "They are very resistant to dying," says Kirkland. So, in an attempt to clear them out of the body, he and his team set out to discover compounds that could reactivate apoptosis, focusing on safe, natural



Quercetin, present in some fruit and veg, is a potential senolytic

MAY/ALAMY

Don't try this at home

Several of the experimental drugs designed to eliminate toxic senescent cells (see main story) are available to buy over the counter or online. Quercetin, for instance, is a common supplement in health food shops in the UK, US and elsewhere. It is also present in many dietary sources, including citrus fruits, apples, onions, green tea and dark berries.

While eating more fruit and vegetables is good for your health in many ways, taking quercetin as a supplement in the hope of reversing ageing processes in the body is a bad idea, says James Kirkland at the Mayo Clinic in Rochester, Minnesota, who researches senescent cells and the drugs designed to destroy them.

Despite these warnings, there is a community of biohackers who take these drugs on a regular basis. They are "very cheap, readily available and easily used", says one user who asked to remain anonymous.

Don't follow their example. These compounds can be toxic, warns Linda Partridge at the Max Planck Institute for Biology of Ageing in Cologne, Germany. "Make sure your readers don't take these agents," Kirkland tells me. "The only place for them at the moment is in clinical trials that are carefully controlled."



JOZEF POLC/ALAMY

Exercise may be one way to reduce levels of senescent cells

"This is the first large clinical trial in modern medicine to test if human ageing can be treated with a drug"

compounds and drugs already approved for human use. In 2015, they reported a double success, with a cancer drug called dasatinib (D) and a plant compound called quercetin (Q). Both killed senescent cells in cell culture, and a combination of the two was more powerful than either alone. When old mice were given D+Q, it significantly rejuvenated them. Two years later, the researchers found similar success with the combination of another cancer drug, navitoclax, and a plant compound, fisetin. Together, these treatments were dubbed senolytics.

In animals, senolytics were found to be effective at extending both healthspan and lifespan. They also slowed the progression of numerous age-related conditions or reversed the damage caused by them, including dementia, frailty and cardiovascular disease, among others.

In 2016, senolytics moved into clinical trials in humans. The first to report results was for a rare and debilitating lung disease called idiopathic pulmonary fibrosis (IPF). Its cause is unknown, but it is associated with a high senescent cell burden. The researchers gave 14 people with the condition nine doses of D+Q over three weeks. Five days after the last dose, the participants could walk further and faster and rise from a chair more easily, though measures of lung function hadn't improved.

IPF isn't technically an age-related condition, despite it usually developing only after the age of 50. But the trial is proof of principle that senolytics can help with conditions in which senescent cells are a problem. "That looks as though it might be a success story," says Partridge.

Reversal of fortunes

There are now around 20 clinical trials of senolytics in the pipeline – though, paradoxically, none of them actually target ageing per se. This is a long-standing problem with developing general anti-ageing drugs: there are no recognised markers of ageing that can be used to test whether they are working. So clinical trials have to focus on individual age-related conditions. Those in the ongoing trials include Alzheimer's, osteoarthritis, kidney disease and age-related macular degeneration.

Few have reported results as yet, but one has given cause for optimism. A preliminary report from a trial on diabetic kidney disease found that taking D+Q for just three days significantly reduced the burden of senescent cells.

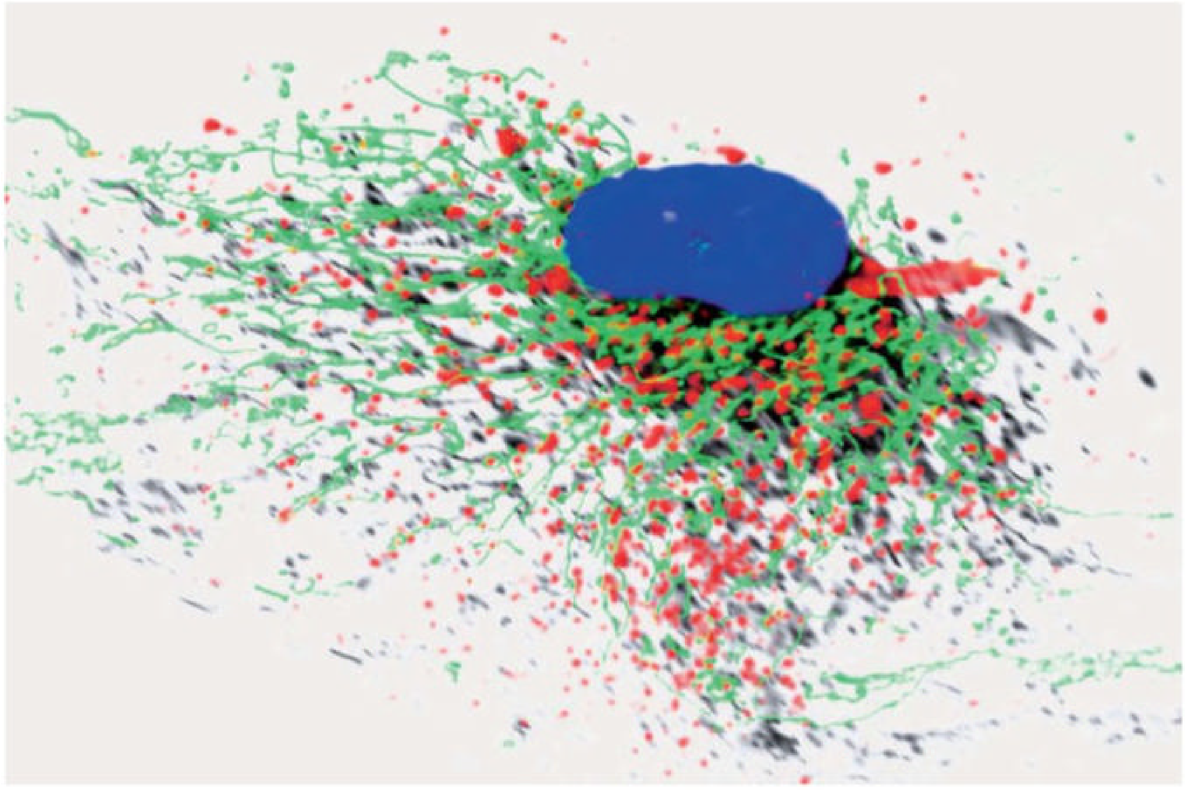
In the best-case scenario, a senolytic will be found to work for a very specific and severe disease – perhaps IPF – which would justify testing other senolytics for less severe conditions and, ultimately, running a trial to see if they slow down the onset of age-related diseases in general (see "Don't try this at home", page 40). The senolytics that Kirkland's group works with are already approved by the US Food and Drug Administration (FDA), so wouldn't need to go through a full-scale clinical trial. Still, the timeline from here on in is unclear, says Kirkland.

Arguably, however, the first box has already been ticked. Some doctors already prescribe dasatinib for a fatal condition called progressive systemic sclerosis, which Kirkland says is known to be driven by senescent cells.

The ultimate hope is that senolytics will be a route to slowing down the ageing process in general, not just those diseases caused directly by senescent cells. According to what Kirkland calls the unitary theory of fundamental ageing mechanisms, many of the processes of ageing – such as chronic inflammation, DNA damage and mitochondrial dysfunction – are tightly interlinked. "If you have one of them, the rest tend to be turned on, so you can get these vicious cycles," he says. "It's looking more and more like many of these processes reinforce each other." The upside of this is that intervening in one ought to attenuate the others.

It isn't all plain sailing, however. Annoyingly for me, in 2020, a small-scale human trial for knee osteoarthritis was canned after failing to hit its target of alleviating pain. But Kirkland points out that the agent used – an experimental anti-cancer drug called nutlin-3a – is only a weak senolytic and can, in some circumstances, cause senescence.

There is also a growing realisation that not all senescent cells are the same and that the SASP can vary from cell to cell. "Senescent cells actually have a very broad range of [SASP characteristics] depending what tissue they were derived from and what stress caused them to go senescent in the first place," says Partridge. That means there is still more basic groundwork to do, characterising all of the different SASPs and pinpointing which are ›



GLYN NELSON (CC BY-NC-SA 2.0)

A senescent cell spewing out a toxic cocktail of chemicals

"Exercise has been shown to reduce senescent cells, though only after a gruelling, high-intensity session"

causing disease. "I think we need much more precise information on that," says Partridge.

A related problem is that, even in people who have tipped over the threshold whereby senescent cells cause more harm that good, the cells still perform a vital function. "Some senescent cells are there because they're important for tissue regeneration and wound healing," says Partridge. "You don't want to kill those guys off. You want [to target] the guys who've been hanging around for ages who have had DNA damage."

If senolytics inhibit normal wound healing, their use in humans could be "essentially doomed", argues Sundeep Khosla, also at the Mayo Clinic in Rochester. Two studies found that administering senolytics to mice with skin or lung injuries inhibits wound healing, which doesn't bode well, he says. But, paradoxically, three other studies show that senolytics enhance the healing of bone fractures.

There is a way to reconcile these findings. The skin and lung studies used continuous drug dosing to take out all the senescent cells, whereas the bone studies employed a regime called "hit-and-run" – the drugs are given intermittently rather than continuously, allowing some senescent cells to survive. This implies that there is a sweet spot for the number of senescent cells to obtain anti-ageing effects without disrupting wound healing, says Khosla. But more research is needed.

Hit-and-run has another benefit in that it reduces the risks of side effects, which are associated with several senolytics, says Kirkland. Dasatinib, for instance, can cause fluid on the lungs and suppression of bone marrow – but these only appear after several weeks of continuous use.

Another possible solution is to give up on culling senescent cells and to just tame them instead. Another class of drugs called senomorphics (also known as senostatics or senomodulators) is in the offing. These medications suppress the SASP rather than push senescent cells into self-destruction. The two most promising drugs, metformin and rapamycin, are already on the radar. The American Federation for Aging Research is currently preparing a series of six-year clinical trials to test whether metformin – a diabetes drug with proven anti-ageing properties in animals – can delay the onset of further age-related conditions in people who already have one. Its TAME (Targeting Aging with Metformin) trial is "the first large clinical trial in modern medicine to test if human ageing can be treated with a drug", according to Hong Zhu at Campbell University in Buies Creek, North Carolina. Rapamycin, meanwhile, increases lifespan and healthspan in animals and is currently being tested as an anti-ageing drug in dogs.

Metformin has proven anti-ageing benefits in animals



DARREN LEHANE/ALAMY

There is a possible downside with senomorphics, however. They generally need continuous dosing rather than hit-and-run, which probably increases the risk of side effects, says Kirkland. Continuous high doses of rapamycin in mice, for example, are toxic to the kidneys and gonads and increase susceptibility to infections.

While we wait on senolytic drugs, other options already exist. Exercise has been shown to reduce the burden of senescent cells in skeletal muscle and fat tissue, though a recent study found that the benefits only accrue from a gruelling session of high-intensity exercise. Caloric restriction is also a senolytic, says Kirkland. Meanwhile, short bursts of ultrasound have been shown to reverse senescence in cultured human cells and to rejuvenate old mice through an as-yet unknown mechanism.

An awful lot hinges on the success – or otherwise – of senolytics. One of the goals of the TAME trial, says lead investigator Nir Barzilai, director of the Institute for Aging Research at Albert Einstein College of Medicine in New York City, is to persuade the FDA to recognise ageing as a disease in its own right, which could change the landscape of the entire field. "The FDA will accept TAME results if they are positive," he says. In doing so, it will open the door to treating ageing as something that can be "cured". I am down on my creaky old knees hoping that happens. ■



Graham Lawton is features writer at *New Scientist*


NABIL NEZZAR

Think like a hacker

Cyber-lawyer **Scott Shapiro** believes there is more to beating hackers than getting better at programming. He tells David Adam why online security is as much about humans as technology and how understanding both can keep us safer online

Scott Shapiro wants to teach the world how to hack. An expert on legal philosophy and the founding director of Yale University's Cybersecurity Lab, his day job is to provide cutting-edge teaching for Yale law students on how the online world works and how to keep it secure.

He believes that we can only effectively tackle cybercrime if we understand not only how people hack, but why. In his new book *Fancy Bear Goes Phishing* he explores true stories from the front line of cybercrime, from the hacker known as Dark Avenger who wrote the first mutating computer virus, to the teenage boy who hacked Paris Hilton's phone because he wanted to be famous. The book's title derives from the exploits of Fancy Bear, a group working for Russian military intelligence that hacked the governing body of the US Democratic Party during the 2016 presidential campaign.

Shapiro talks to *New Scientist* about what we can learn from hackers, why he wants to teach the world to hack in a free online course and just how close he came to committing cybercrime himself.

David Adam: You teach people to hack. Why?

Scott Shapiro: I think it's very hard for people to understand how hacking works when it is described abstractly. It's a bit like explaining how to do carpentry through a description – you can read the words, but you don't really

understand what's happening. If you teach people how to hack, they can understand in a much more intuitive way not only how it works, but also how to protect themselves against hackers.

Is it difficult to learn how to hack?
It's upsettingly easy to learn to hack. My teaching partner and I put together an online course with 12 videos, each an hour long, plus assignments and explanations on how to hack. So, that's 12 hours of videos with some homework. That's open to anybody and if you do it, you'll learn not just how to hack, but more importantly you'll learn why it works. I want to teach people how to understand how information is stored, manipulated, transferred and, ultimately, exploited.

Your book says there is no technical way to stop hacking. Why is that?
There are many technical solutions to improve cybersecurity, such as protecting accounts with passwords, providing easy-to-use encryption on the internet and sophisticated firewalls. But there's no technical way to achieve perfect cybersecurity.

Even if we just want to improve cybersecurity, as opposed to perfecting it, it is a mistake to think that the way to do that is through technical means. It's primarily a human problem. We need to try to fix the political, social and psychological vulnerabilities that generate vulnerable code. If people just try to fix vulnerable code, in some sense they have already lost the game.

What changes are required to tackle these vulnerabilities?
We need to focus on what I call "upcode" – the social, legal, economic and psychological factors that drive, encourage and permit the anti-social, disruptive and illegal behaviours of hackers.

The UK has been very forward-leaning in this respect. The National Crime Agency published a report on "pathways into cybercrime" to understand how young people start engaging in low-level deviant behaviour online. There have been attempts to try to have law enforcement meet with these people to try to divert them away from criminality. We know that mentorship can do that. In the US, new types of competitions have been created to divert people who might ordinarily commit crimes on the internet into projects where people engage in activities that are safe.

> "Cybersecurity is primarily a human problem that requires human solutions"

While we work out how to tackle hacking, is it really a good idea to teach large numbers of people how to do it?
Somebody needs to teach people what's happening. The idea is to provide this information for interested people, presented in a responsible way, so that they can learn it and understand the news and what's happening around them. And to make them more secure.

When we teach the course, we repeat – over and over again – the absolute importance of not hacking other people without their consent. Some people who do our Yale Law School course go on to learn more about cybersecurity and become experts. Others go to work for the US Department of Justice, or they go into private cyberlaw practice, and they are newly empowered to understand things that almost nobody understands.

In your book, you describe various high-profile hacks. Do you have a favourite?
I'm partial to the Robert Morris hack. Morris was a graduate student at Cornell University [in New York] in 1988 and he wanted to do an experiment to see if he could infect lots of computers on the internet. He figured out multiple ways of getting a worm to spread over the internet. He didn't intend to cause any harm, though it ended up crashing the internet and he was ultimately convicted for doing so.

I like it a lot because it was technically very interesting, how he was able to allow his worm to spread. But it also raised novel legal questions about the desire to hold people responsible for intentionally releasing viruses and worms onto the internet if they didn't intend to create any damage, but nevertheless did so.

At the time, Morris's dad was chief scientist for cybersecurity at the US National Security Agency (NSA). A lot of the things he did, he learned from his father. I feel a kindred spirit with Morris. We're the same age, we used to





Now in a museum, the floppy disk with the code that hacker Robert Morris (left) used to crash the internet in 1988

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State-funded Russian hackers were accused of disrupting the 2016 US election campaign

both go with our dads to their work at Bell Labs, (where Morris senior worked prior to his move to the NSA). We never met, but I know we were both really interested in the UNIX operating system and we both read all the manuals.

It seems that you have more sympathy for some of the hackers than for the big tech companies like Microsoft. Why is that?
Well, partly because it's adults versus children. And because I want to hold Bill Gates to account for, in my opinion, wanting to crush the free and open internet and not prioritising security. Also, the hackers I'm talking about are often young boys who are trying to win the respect and esteem of their peers, which is something I think we all can relate to. They often get sucked into a cycle of escalating transgressions, which is a very well known behaviour pattern in human psychology. And they tend not to be, you know, billionaires.

What have we learned from the hacks you write about that could help tackle cybercrime?
One of the things that has been said many times is that it's a cat-and-mouse game. Somebody does something, you fix it. Somebody does something else and, again, you fix that. They respond and so on. Cybersecurity is so much better than it used to be, but the attacks are so much better than they used to be too. I feel this cat-and-mouse game will keep going forever.

The question is, can we win the game more than we are right now? I think the answer is yes if we start to view cybersecurity as primarily a human problem that requires human solutions. We need to develop rules and norms and principles to regulate how computer code is written, deployed, tested and, ultimately, used. It's always going to be a whack-a-mole situation, but we can make it so that it's not so frustrating.

In the movies, a hacker who is caught is always offered a job with the government. Does that happen in real life?
Yes, that's what happened in the last hack in the book. The three hackers released malware called Mirai that targeted and took control of devices connected to the internet of things, like security cameras and smart toasters. Instead of being incarcerated, they were given five years of community service, during which time they worked for the FBI and helped stop a nation-state hacking group. They were mentored by the FBI agent who caught them. The special agent diverted them into a socially productive activity instead of a socially wasteful activity like putting them in jail.

What would you say to *New Scientist* readers who want to make sure their own computing is as secure as it can be?
Don't freak out. Ordinary people aren't high value targets. Cybercriminals don't want to hack you, they want to make money. That means they don't want to spend time on people who take even minimal precautions. I think the most minimal precaution you could take is never clicking on a link or opening an attachment in an email from somebody you don't know.

Has artificial intelligence changed hacking?
Yes. Cybercriminals tend to be non-native English speakers who target the English-speaking world, and this provides a natural barrier to the effectiveness of their phishing emails. They need to write English not only with correctly spelled words, but also to write idiomatically. This has been very difficult. But ChatGPT allows everyone to write a good hacking email, a good phish, so it's going to become even more important not to click links in emails from people you don't know.

Have you ever hacked a computer that you shouldn't have?
Well, I got up to the edge. It was the Yale law library website. I did what was called a cross-site scripting attack, which injects malicious script, and it generated a link that I could have used to send an email, let's say to the dean, to say "hey, look at this new book that the library is ordering" and have her click on it and then gain access to her machine.

Of course, I would never do that, but I was proud of myself for being able to get to the line. I didn't gain unauthorised access, but I was tempted. I feel like I'm a responsible person, but you just get caught up in it. This is the problem, which I repeat over and over and over in my classes. You will want to use this. Do not use this. ▮



David Adam is a science journalist based in Hertford, UK, and author of *The Man Who Couldn't Stop*



The South Island kōkako, last officially sighted in 1967

A bird in the hand

The rediscovery of lost bird species is inspiring, but what is it worth to science, wonders **Penny Sarchet**

IT WAS the first day of 2023 and John Mittermeier was feeling dispirited. He and his colleagues had been in Madagascar for 10 days searching for a bird last seen more than two decades ago. Long treks looking for its native forest habitat had revealed swathes of land cleared for agriculture and vanilla production. They had faced rain and leeches and Mittermeier had been ill much of the time. And, in two days, they would start heading home.

The team had just moved to a new location and Mittermeier had awoken full of hope, but he soon realised that the environment there was also degraded. "I went from a high of anticipation to 'this is a disaster'," he says. By 9 am he was walking back to camp. Then it happened. "Boom! There was a dusky tetraka."

This little green bird with its yellow throat and eye rings is so special that it makes the "most-wanted" list of the Search for Lost Birds. The initiative, launched in 2021, aims to use the excitement that elusive species inspire to direct the world's army of birdwatchers, researchers and conservationists to seek out avians lost to science. It even offers financial support for some searches.

Looking for long-lost species helps conservationists decide where their focus should be, says Christina Biggs at conservation organisation Re:wild. Finding them can bring hope. "We live in a time of apocalyptic climate-change fatigue," she says. Rediscovery stories can combat that. But how do you go about finding something that hasn't been seen in decades? And do remarkable finds like Mittermeier's really make any difference?

Nearly half of all bird species are in decline and one in eight are threatened with extinction. So, choosing which should take priority isn't easy. The Search for Lost Birds, a collaboration between Re:wild, American Bird Conservancy (ABC) and BirdLife International, focuses on "lost" species: ones with no captive population that haven't been verifiably documented for over a decade, but that aren't yet classified as extinct. There are around 140 of these. Compilers of the most-wanted list homed in on species that would benefit most from being found. To finalise their choices, they picked 10 birds from around the world, reflecting a diversity of species, that had last been seen in places safe and accessible enough to explore (see "The 10 most-wanted lost birds", page 48).

Hunting for such species sounds romantic, but perhaps not such a good conservation strategy. It seems logical to conclude that the longer a bird has gone unseen, the more likely it is to be extinct. Two species on the list – the Himalayan quail and the Siau scops-owl – have been missing for over a century. However, Mittermeier, who works for ABC, recently made another rediscovery of a bird that, although not on the most-wanted list, shows why even long-lost birds can't be written off.

The black-naped pheasant-pigeon, a native of Fergusson Island off eastern Papua New Guinea, hadn't been documented in 140 years. "There are not many birds that have been lost for a very long time and are not considered extinct," says Mittermeier. "It stood out as one of those that is critically endangered, but had not really received a lot of attention." He decided to try to find it. "How you look for a bird varies, depending on the bird," he says. In this case, it entailed putting together a team of experts from the US and Papua New Guinea, travelling to Fergusson and interviewing people living in remote areas. "This is a chicken-sized terrestrial bird," says Mittermeier. "It seemed like an obvious one to talk to people about."

"Rediscoveries like this highlight that the line between 'lost' and 'extinct' is blurry"

The islanders have a detailed knowledge of local natural history, but for three weeks the searchers encountered nobody who had seen the pheasant-pigeon or even heard of it. Then they met Augustine Gregory, a local who had spotted it several times and could also describe its call and gait. He took them to some rugged ridges and valleys within primary forest in the centre of the island where they spent several days searching. "We did not hear anything and started running out of food," says Mittermeier. Exhausted and with little time left, the team tried to come to terms with having spent weeks looking, only to find nothing. "Then we picked up our camera traps," he says. Astoundingly, they hadn't just found the black-naped pheasant-pigeon, they had captured video of it. In November 2022, the bird-watching realms of the internet were overjoyed at the news.

Rediscoveries like this highlight that the line between "lost" and "extinct" is blurry. The International Union for Conservation of Nature defines a species as "presumed extinct" when exhaustive surveys in its expected habitat have failed to record an individual. "That's nebulous," says Biggs. "What's an exhaustive search?" Nevertheless, there is conservation value in declaring a species extinct. "We all want to be hopeful that these things are alive," she says. "But if you don't make the call when it's not there, you're putting resources into something that could ›

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"Is this focus on just a few species a good idea with so many birds in trouble?"

be used where there is a critically endangered animal that could still be saved."

That is what has happened in the case of the ivory-billed woodpecker, argue Jeff Troy at Temple College, Texas, and Clark Jones, a birder affiliated with Colorado State University Pueblo. This iconic bird was last officially sighted in the US in 1944. Then, in 2005, hope that it still survives was rekindled when researchers released video footage taken in Arkansas. Although other researchers subsequently threw doubt on this footage, Troy and Jones have calculated that over 578,000 hours were subsequently spent looking for the bird and that more than $20.3 million in federal and state funding was spent on the woodpecker. They argue that all this money and effort could have been better used on other threatened and endangered species. Thrilled as they would be to see the ivory-billed woodpecker rediscovered, they agree with the US Fish and Wildlife Service, which proposed in 2021 that it should be declared extinct.

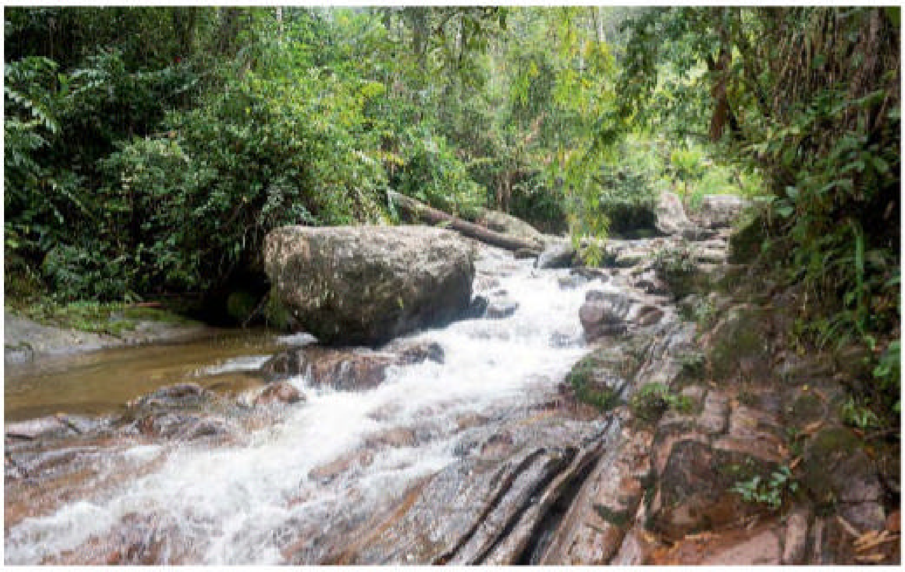
This dilemma is felt keenly by conservationists in New Zealand looking for the South Island kōkako, which is on the most-wanted list of the Search for Lost Birds. Like many of the country's birds, it suffered great losses after the introduction of cats, rats and stoats. The last accepted sighting of this dark bird with an orange face wattle, or skin flap, was in 1967. It was declared extinct in 2007 but, after a sighting that same year, it was reclassified as "data deficient". In 2010, the South Island Kōkako Charitable Trust was set up to collect more data. The trust has been searching for the species ever since. But, says trust manager Inger Perkins, every year at the AGM they ask themselves: "Do we still need to do this? Is there still value in us putting this effort in?"

There have been hints it still exists. In 2017, the trust launched a campaign, asking anyone going deep into backcountry areas to look for the bird and report sightings. "After that, we started getting heaps of reports," says Perkins. But no one has yet won the NZ$10,000 the trust is offering for evidence of its existence. This year could see the final push, with Re:wild funding a search of key areas in the north-west of the island. "It's going to be more recorders, more cameras, more hands on the ground – almost like a police search across the hillside where there's been a murder," says Perkins.

That might sound extreme, but a well-chosen search strategy can make the difference







JOHN C. MITTERMEIER

A team including conservationists at The Peregrine Fund (above) rediscovered the dusky tetraka (above left) near a river in Madagascar (left)

The 10 most-wanted lost birds

Dusky tetraka
Missing since: 1999
Last known location: Madagascar
Status: Found

South Island kōkako
Missing since: 2007
Last known location: New Zealand
Status: Not yet found

Jerdon's courser
Missing since: 2009
Last known location: India
Status: Not yet found

Itombwe nightjar
Missing since: 1955
Last known location: Democratic Republic of the Congo
Status: Not yet found

Cuban kite
Missing since: 2010
Last known location: Cuba
Status: Not yet found

Negros fruit-dove
Missing since: 1953
Last known location: Philippines
Status: Not yet found

Santa Marta sabrewing
Missing since: 2010
Last known location: Colombia
Status: Found

Vilcabamba brushfinch
Missing since: 1968
Last known location: Peru
Status: Not yet found

Himalayan quail
Missing since: 1877
Last known location: India
Status: Not yet found

Siau scops-owl
Missing since: 1866
Last known location: Indonesia
Status: Not yet found



JORGE ELQUIN TORO ARIAS

The Santa Marta sabrewing was rediscovered in Colombia in 2022

between success and failure, as the story of the hunt for the dusky tetraka testifies. In late 2022, Mittermeier headed to Madagascar to team up with Lily-Arison Réné de Roland, a local conservationist at The Peregrine Fund with an impressive track record of finding rare birds, including rediscovering the Madagascar pochard, a reddish-brown duck. The dusky tetraka is a warbler-like bird, hard to distinguish from similar species. So Réné de Roland decided the right way to find it was mist-netting – hanging fine mesh between trees to catch birds without injuring them. The disadvantage of this is that it only allows you to search a small area.

In December, the team members set out for the rainforest of northern Madagascar, the place where the last definitive record of the dusky tetraka had been collected in 1999. After more than 40 hours driving and a 5-hour walk, they finally reached its last known location only to find that the land had been cleared, despite being within a protected area. Nevertheless, they set up nets in nearby forest and waited. After five unsuccessful days, they decided they were catching the wrong kinds of birds – species you wouldn't expect to find in the same place as the dusky tetraka – so they enlisted the help of local people to seek a more promising site. Then, with only a few days of the expedition left, the researchers moved to forest at lower altitude.

Excitement and panic

When Mittermeier spotted a pair of birds in undergrowth there, he knew right away they were dusky tetraka. He describes experiencing 2 minutes of excitement and panic before they were gone. "All of a sudden, you're back to where you were before," he says. Without proper documentation, such as photos, sound recordings or a specimen, a species remains officially lost. This is where Réné de Roland's strategy paid off. The following day, the team found a dusky tetraka in the mist nets and was able to measure and photograph it. What's more, the observations were confirmed by a partner team searching in eastern Madagascar that had also managed to catch one.

The rediscovery of a lost bird is a cause for celebration. But that's just the first step, says Esteban Botero-Delgadillo at the Colombian conservation organisation SELVA. In 2022, he was involved in announcing the rediscovery of another bird on the most-wanted list, a tiny, emerald green hummingbird called the Santa Marta sabrewing. Many lost birds are poorly understood so, when found again, they must be studied to get the information needed to protect the species. "Once we understand it, then we will have a better view of its current status and threats, and then you can efficiently invest resources for conservation," says Botero-Delgadillo. To that end, he and his colleagues are now studying this bird in the wild, not least to find out whether it migrates to the highest part of Colombia's Santa Marta mountains to breed, as previously suggested. Meanwhile, in Madagascar, Réné de Roland hopes the rediscovery of the dusky tetraka will bring funding to train members of local associations that manage the protected sites it inhabits.

Even with these successes, there is still the question of whether this kind of focus on just a few species is a good idea when so many birds are in trouble. Mittermeier argues that looking for the right lost species, in the right way, is a cost-effective approach for meaningful conservation. Searches require about $5000 to $10,000, he says. "I think most people would agree that's a small investment when it could basically be the difference in whether or not a species goes extinct."

Besides, the Search for Lost Birds specifically selected species in under-studied locations where any new data that is collected could help fill knowledge gaps. Briggs believes this can pay dividends, pointing to an unsuccessful 2021 search for the Sinú parakeet, a Colombian bird missing since 1949, that recorded 30 bird species not officially seen before in the Córdoba area. James Eaton, an expert on Indonesian birds, reaped similar rewards when he and his team went looking for the Siau scops-owl. Although they didn't find it, their expedition shed new light on the ecology of the tiny Indonesian island of Siau. "We were able to survey for other species," he says. "The endangered Siau pitta, a bird only found on Siau and its satellites, was much more numerous than expected. So some good has come out of it." Biggs goes even further. "There's absolutely no failure in searching because some scientific knowledge always emerges," she says.

Less than 18 months after the launch of the Search for Lost Birds, two species on its most-wanted list have been found, the black-naped pheasant pigeon has been rediscovered after 140 years and birdwatchers are waiting eagerly for further news from ongoing searches, including the hunt for the South Island kōkako. As for Mittermeier, he isn't finished yet. In June he will be returning to the Solomon Islands to continue seeking the Makira moorhen, a bird last recorded in 1953. Very little is known about the species, but it is thought to be flightless with striking blue feathers. There is just one warning for those seeking the thrill of its rediscovery. "It's so cool," says Mittermeier, "that the scientist who first saw it nearly fainted in excitement." ∎



Penny Sarchet is the news and digital director at *New Scientist*

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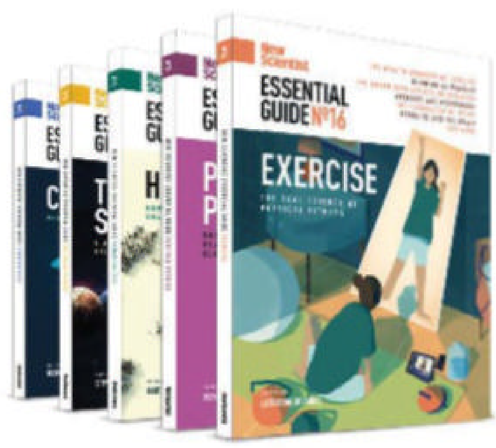
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The science of cooking

Foraging for tasty treasure

The pungent flavour of wild garlic probably evolved as a defence against herbivory, but it doesn't deter humans, says **Sam Wong**



Sam Wong is assistant news editor and self-appointed chief gourmand at New Scientist. Follow him @samwong1

What you need

150 grams wild garlic leaves (you could substitute ramps or *Allium triquetrum*)
300 millilitres or 1 ¼ cups extra virgin olive oil
100 g or ¾ cup pine nuts (or other nuts)
100 g or ½ cup parmesan (or a vegan/vegetarian equivalent)
1 lemon

The science of cooking appears every four weeks. Share your cooking successes with us on Twitter and Instagram @newscientist, using the hashtag #NewScientistCooking

Next week

60-second psychology

A FEW weeks ago, just outside London, I found a foodie jackpot: a patch of forest carpeted with wild garlic. The white flowers hadn't yet emerged from their buds, so I might not have noticed the patch if I hadn't been looking for it. When I last picked wild garlic in Cornwall a few years ago, the heady aroma from its blooms was so strong you could hardly miss it.

The plant usually called wild garlic in the UK, *Allium ursinum* (pictured), can be found all over Europe and Asia in damp and shady woodland. It begins to grow in February, with flowers typically appearing in April, but the above-ground parts of the plant wither as summer arrives. You can eat all parts of the plant, though you should leave the roots so it can grow back next year.



DEBORAH VERNON/ALAMY

Like other members of the *Allium* genus, wild garlic contains a high concentration of chemicals called cysteine sulphoxides. These are odourless and non-volatile compounds, but when the plant's cells are damaged, enzymes convert them into secondary products called thiosulphinates. These include allicin, the molecule largely responsible for wild garlic's pungent flavour. This chemical arsenal probably evolved as a defence against herbivory, but it is hopelessly maladaptive when it encounters garlic-loving humans.

If you plan to forage for any wild plants, do consult a proper identification guide and don't eat anything unless you are sure you have identified it correctly – there are many poisonous plants that look similar to edible ones. *A. ursinum* can easily be confused with lily of the valley (*Convallaria majalis*), which contains cardiac glycosides like those found in foxgloves and cane toads.

Some other alliums are known as wild garlic in the US, including *Allium triquetrum*, which is called three-cornered leek in the UK. It is native to south-western Europe, but it is present as an invasive species in places including the UK, US and Australia. It can be found from autumn until spring.

Allium tricoccum, commonly known as ramps, is also popular with foragers in North America. Typically out from April to May, it looks like a spring onion with a red-tinted stem and a leafy top, and has a strong garlicky flavour.

My favourite way to eat wild garlic is to turn it into pesto, which you can also do with ramps. In her excellent book *Salt, Fat, Acid, Heat*, Samin Nosrat advises a light touch when using a food processor to make pesto, as the heat can cause the leaves to turn brown. To avoid this, roughly chop them by hand first, then pulse in the machine with olive oil and nuts, stopping frequently to push down any leaves that get stuck on the sides. When the mixture resembles a paste, tip it into a bowl and stir in some grated cheese, a pinch of salt, some lemon zest and a squeeze of lemon juice. Taste and add more salt and lemon if desired. Store it in jars with a layer of olive oil on top. ■

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6 September 2023 | 13 days

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Discover a different side of Vietnam in this wide-ranging tour that covers geology, stunning landscapes, animal conservation and history. Starting off in Hanoi with stays in Cuc Phuong National Park, sailing down a river in the Ninh Binh valley, cruising the Halong Bay and trekking to the famous Hang Tien cave. Finishing in Hue, the ancient capital of Vietnam.

Experience tropical jungles, limestone caves, blissful villages and amazing feats of underground engineering. Immerse yourself in local culture and sample Vietnamese cuisine, ranging from street food to dining like royalty.

9 September 2023 | 9 days

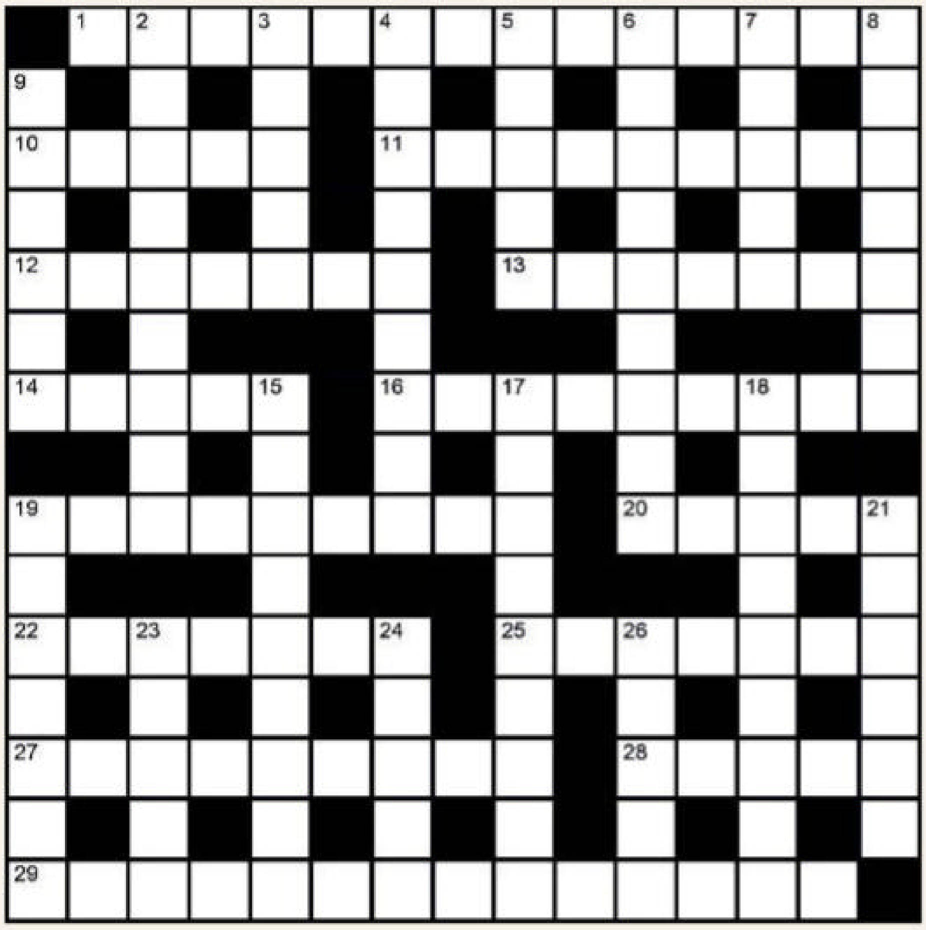
Salt mines to mountain peaks: The geology of the Pyrenees: Spain

Travel along backroads and through small towns to explore the amazing landscapes, unique earth history, culture and gastronomy of the Catalan Pyrenees. The spectacular landscapes were formed by the collision of the Iberian Peninsula with Europe, and this tectonic impact is mirrored in the many cultural collisions that have occurred in the region

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Quick crossword #133 *Set by Richard Smyth*



Scribble zone

Answers and the next cryptic crossword next week

ACROSS

1 Glowing (14)
10 Manipulated (a system) (5)
11 Upland game bird (3,6)
12 Cell division (7)
13 Placed authoritatively; stamped (7)
14 Electronic noise (5)
16 Means of interaction (9)
19 Collective; composed of multiple units (9)
20 Of a gas, unreactive (5)
22 Underground plant stem (7)
25 Prickly plant in the family Asteraceae (7)
27 Broadcasting tower (5,4)
28 Healthcare practitioner (5)
29 Leukocyte (5,5,4)

DOWN

2 Tendon in the back of the leg (9)
3 Edges (5)
4 City struck by an atomic bomb on 6 August 1945 (9)
5 Spokes (5)
6 Ferrous waste metal (5,4)
7 Horse genus (5)
8 Pedal mechanism for converting reciprocating motion into rotating motion (7)
9 Asexual; without sexual organs (6)
15 Socially stimulating chemical secretion (9)
17 Eighth semiprime (6-3)
18 Airway medication, marketed as Ventolin (9)
19 Pilots, navigators and attendants, for example (7)
21 Fifth prime (6)
23 Large lemur (5)
24 Form of online communication (5)
26 Type of chemical bond (5)

Our crosswords are now solvable online
newscientist.com/crosswords

Quick quiz #202
set by Bethan Ackerley

1 In what year was the Pioneer 10 space probe launched?

2 What is the primary psychoactive alkaloid in the peyote cactus?

3 Is the photon a boson or a fermion?

4 Jemdet Nasr was a city of which ancient civilisation?

5 Which fruit is produced by *Malus domestica*?

Answers on page 55

Puzzle
set by Howard Williams
#222 A question of balance

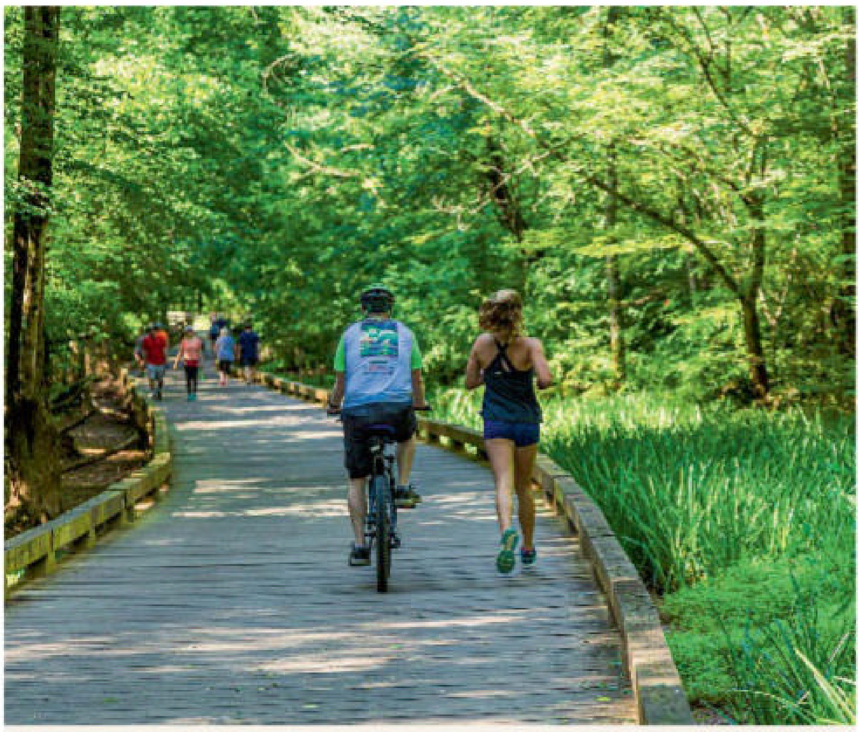
Being sentimental, Patty likes to use her grandmother's beam scales when weighing out ingredients to make a birthday cake for her own granddaughter. The only problem is that the scales aren't accurate as the two arms are of slightly different lengths.



To overcome this, she uses both pans and measures half the required quantity in each. For example, to weigh 2 kilograms of flour, she will put a 1-kilogram weight in the right-hand pan and weigh the flour on the left-hand pan, then place the weight in the left-hand pan and weigh a second batch of flour on the right-hand pan. The combined portions of flour will, she thinks, weigh exactly 2 kilograms.

Is she right or will she have more or less than 2 kilograms?

Solution next week



DARRYL BROOKS/ALAMY

Who is expending more effort while exercising, the runner or the cyclist?

This week's new questions

On the run **I have just seen two people exercising together. She was running while he cycled beside her. She was only moving herself, but he was moving the bike too. Who expended more effort?** ***John Packham****, London, UK*

Too much time **If humans colonised Mars, how would they calculate time, as a Martian day is longer than one on Earth?** ***James Wilkins****, Southampton, UK*

Doubling up

Why do some of our organs come in pairs, such as kidneys, whereas we only have one heart, one liver etc?

Richard Swifte
Darmstadt, Germany
Unlike rocket engineers, who design in "redundancy" (spare parts for use if key components fail), evolution doesn't waste energy producing spare body parts unless they have a definite survival value, either for the individual or the species. Most creatures in the wild have their work cut out finding enough food to survive, let alone growing unused parts. So it is fair to expect that having two organs fulfils a definite need.

For example: two ears enable better location of sounds; two eyes provide easier estimation of distance and motion if they face forward, and all-round vision if they are on the sides of the head. We have two lungs, but there would be little difference in energy requirements if we instead had one double-size lung. Arguably, having two lungs enables space for the heart more easily.

"More problematic is why we have two kidneys, since a healthy person can function adequately with just one"

More problematic is why we have two kidneys, since a person can function adequately with just one. These organs come in pairs in the large majority of land animals, amphibians and fish. It is likely that our primeval fish ancestors developed pairs too, although since soft organs rarely fossilise, it is currently impossible to be certain.

Norah Fogarty
Developmental biologist
King's College London, UK
Fourteen days after fertilisation, a groove called the primitive streak forms down the midline of the human embryo. Blocks of cells called somites are arranged in pairs on either side of the groove. This sets the body plan of bilateral symmetry with a left and right side. This is different from other organisms like starfish and sea urchins, which have radial symmetry.

Organs form singly along the streak or in pairs on either side of it. For example, the spinal cord and brain form along the streak, so we have one central nervous system. We only have one liver, stomach and thyroid because these develop from the gut tube, which also runs along the streak.

Organs that are formed from the somites, such as the kidneys, ovaries, testes and eyes, appear as pairs. While we have only one heart, it begins as two organs that later fuse together. In fact, the heart retains bilateral symmetry, as it has a left side and right side.

Of course, the interesting thing is that there are always exceptions to the rule. The lungs develop from the gut tube, yet we have two. It is thought that the lung evolved to split in two to increase lung capacity as animals got bigger. In contrast, while the spleen comes from the somites, we only have one. The reason behind this is unknown.

Craig Johnson,
Lecturer in anatomy
University of Bristol, UK
Questions about why our organs look the way they do can normally be answered by looking at the earliest stages of our development.

Many of our organs emerge as buds from a single, primitive gut tube. The lungs, liver and pancreas all develop in this way. How these organs bud from the tube dictates their eventual fate. Paired lung buds emerge, projecting into each side of the ribcage, while several liver buds emerge, fusing together into a single organ. You can still see lobes of the liver – remnants of the buds from early development – with the naked eye.

Simultaneously, the kidneys develop in their own way. They don't emerge from this primitive tube, but form bilaterally on either side of the body from a paired precursor found near the pelvis. The testes and ovaries develop from this precursor too. The kidneys eventually ascend to sit beneath the ribs. However, if the kidneys come into contact with each other during this ascent, they can fuse, forming a single midline organ known as a horseshoe kidney.

When considering why we don't have two hearts or a second brain, evolution shows us that what we already have works so well that there has never been a need to grow another.

@seamusmchugh
via Twitter
Doctor Who has two hearts. You're welcome.

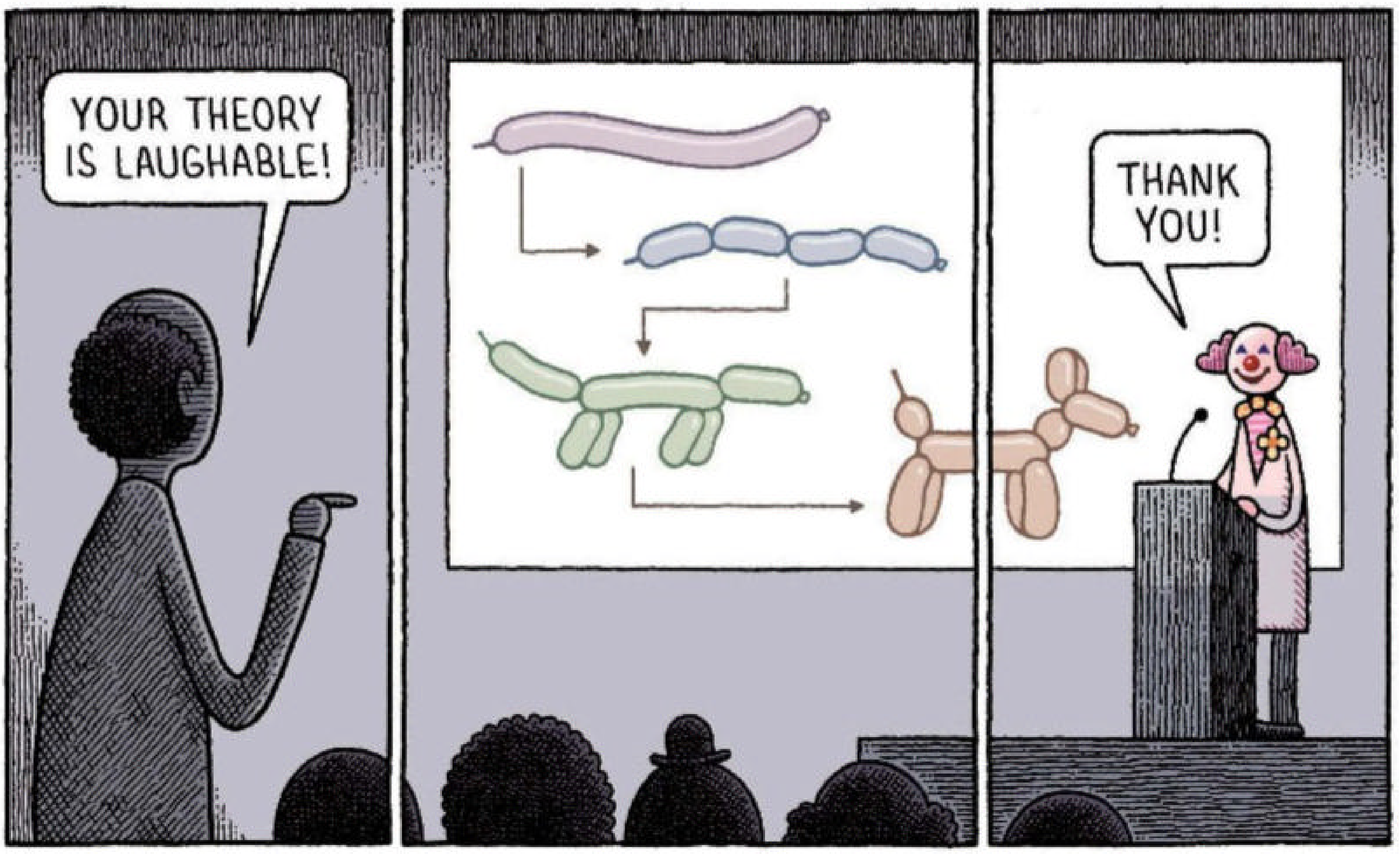
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Accent on America

People from all over Europe settled in North America in the 17th century, so how and when did the North American accent develop?

Pat French
Telford, Shropshire, UK
There isn't a North American accent. There is a collection of accents. As well as those of European origin, there are those of East Asian and African-Caribbean origin and many more. There is a mixture across the countries of North America and they are

Tom Gauld
for New Scientist



constantly changing. There isn't even a universal Indigenous accent in North America. The Hopi and Apache peoples have different accents and languages than the Ojibwe and Métis peoples, for example.

Peter Trudgill,
Author of The Long Journey of English
Norwich, UK
Since people from England left for the Americas, linguistic changes have occurred in the UK that haven't occurred in North America. The usage of the glottal stop as a pronunciation of "t" between vowels, as in "be'er" (better), is a 19th-century innovation typical of British English, but not of North American English.

Since the arrival of English from England, linguistic changes have taken place in the Americas that haven't occurred in the UK. The usage of a d-like sound as the pronunciation of "t" between vowels, as in "bedder" (better), is typical of US English but not British English.

"The evidence suggests that 17th-century English people spoke with what we would now regard as a US accent"

From the beginning, American English was subject to processes associated with contact between different dialects. Although the geographical and social origins of settlers were different in each location, none of the early anglophone settlements on the east coast of what is now the US was settled from a single location in England. So, very early on, contact between different British dialects occurred in the settlements, and this led to the appearance of new, mixed dialects not precisely like any of those spoken in their homeland.

The modern regional variation in accent along the east coast of the US is explained not only in terms of different linguistic changes having taken place in different areas during the past 400 years, but also by the fact that the initial mixtures – and, therefore, the outcomes of these mixtures – were different in different places.

Guy Cox
Sydney, Australia
Your correspondent is asking the wrong question. The evidence suggests that 17th-century English people spoke with what we would now regard as a US accent. The classic example is how the site of the "Old Gate" of Oxford, UK, may have become "Aldates". Quite how it then became canonised to St. Aldates is another matter. The real question is where the English accent came from: I suspect the 18th-century linguistic reformers, who worked to standardise the language and its spelling.

Alan Phillips
Wairarapa, New Zealand
When teaching for the first time in Devon, UK, I mistakenly thought that one of my class was from the US, not a native speaking in a Devonian accent.

Answers

Quick quiz #202
Answers

1 1972
2 Mescaline
3 A boson
4 Sumer
5 Apples

Cryptic crossword #109 *Answers*

ACROSS 1 Codeine, **5** Cache, **8** Empty, **9** Haploid, **10** Vantablack, **14** Ground, **15** Strata, **17** Fullerenes, **20** Concern, **21** Telco, **22** Epsom, **23** Six-pack

DOWN 1 Cleavage, **2** Depend on, **3** Ivy, **4** Exhale, **5** Capacitor, **6** Crow, **7** Eddy, **11** Ad nauseam, **12** Magnolia, **13** Caps lock, **16** Clones, **18** Acne, **19** Inks, **21** Tax

#221 Logical World Cup
Solution

Four of the rows for wins-draws-losses are easy to fill in:

And/orra 4-0-1
Booleivia 3-1-1
Truenisia 2-2-1
Vennezuela 0-2-3

However, Peruf's six points could be 2-0-3 or 1-3-1, and United Gates's four could be 1-1-3 or 0-4-1.

So far in the table, there are nine wins and six losses. That means that between them, Peruf and United Gates must have lost three games more than they won. The only combination that permits this is Peruf 2-0-3 and United Gates 1-1-3.

Publish but be damned

The race – a marathon, run with participants having staggered start times – continues to determine who can publish the most scientific research papers during their career.

The Spanish newspaper *El Pais* reported last month on an up-and-comer, "one of the world's most cited scientists, Rafael Luque", a "prolific chemist" who has been "sanctioned by the University of Córdoba over his research work for other institutions in Russia and Saudi Arabia" and "suspended without pay for 13 years".

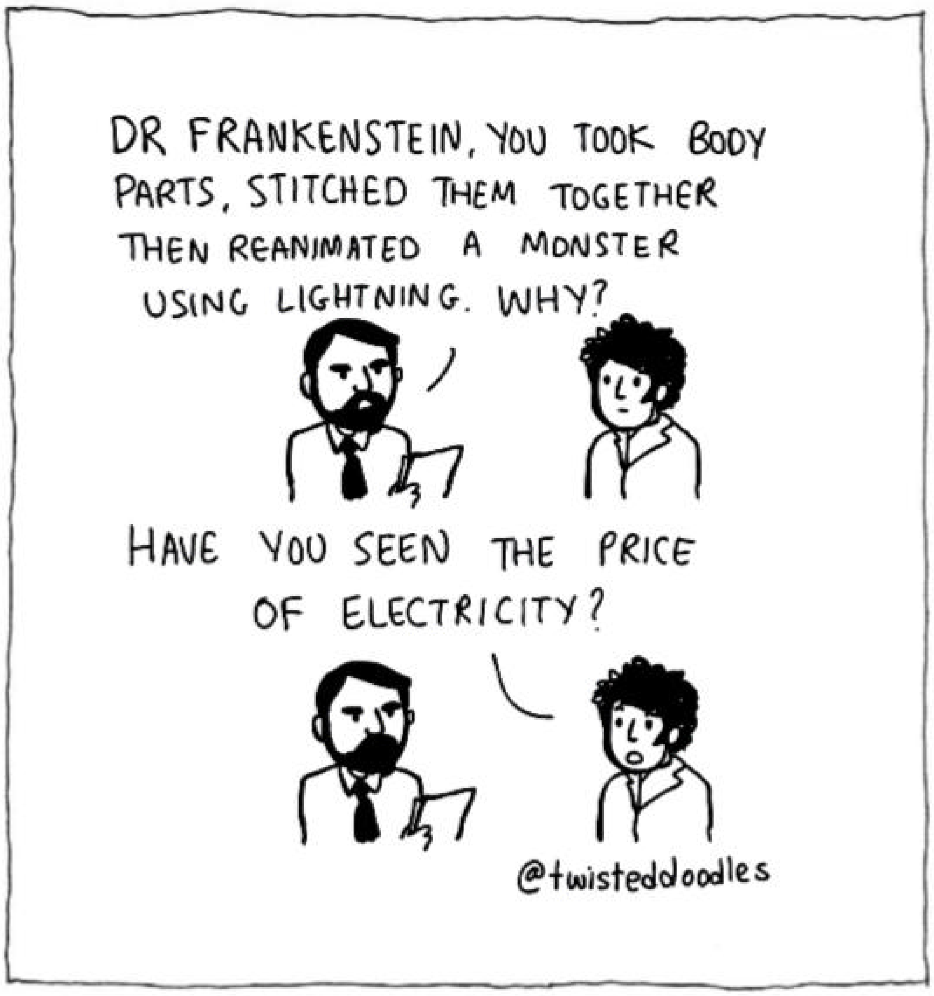
The article explains that Luque, whose full name is Rafael Luque Alvarez de Sotomayor, has already published about 700 papers, and that "so far this year, Luque has published 58 studies at a rate of one every 37 hours".

Impressive as that is, Luque still has a way to go if he's going to catch and exceed Russian chemist Yuri Struchkov. Struchkov was awarded the 1992 Ig Nobel Literature Prize "for the 948 scientific papers he is credited with publishing between the years 1981 and 1990, averaging more than one every 3.9 days".

In high-pressure sports, including the competition for academia's bragging rights (and the swag that becomes available to the most prolific individuals: money, medals, meals with monarchs), impediments are part of the game. Winners manage to overcome many annoyances on the road to triumph and treasure.

Luque's 13-year suspension might delay him, but if he is built of true champion stuff, and if he stays in good health, it could be a mere pothole, rather than a cliff edge, in his relentless stride, stride, stride to numerical and other glory.

Twisteddoodles *for New Scientist*



Got a story for Feedback?
Send it to feedback@newscientist.com
or New Scientist, 9 Derry Street, London, W8 5HY
Consideration of items sent in the post will be delayed

Handy for hanging

1. Animals with hands and arms that make it easy for them to swing from tree branch to tree branch are likely to do a lot of travelling by swinging from tree branch to tree branch.

2. Humans have hands and arms that don't make it easy for them to swing from tree branch to tree branch. That is why humans aren't very likely to do a lot of travelling by swinging from tree branch to tree branch.

Those are conclusions reached by researchers at the New York Institute of Technology College of Osteopathic Medicine. They released a study in the journal *Animals* with a title that invites people to tease out the meaning of unfamiliar words: "How pendular is human brachiation? When form does not follow function".

Handy for standing

1. Older people swing their arms more than young people, as part of keeping their balance rather than frequently toppling over.

2. If everyone is forced to stand while keeping their hands clasped in front of their body, young people are less prone to toppling than older people.

Those are conclusions reached by researchers at Coventry University and Imperial College London in the UK, the University of Duisburg-Essen in Germany and the University of New South Wales in Australia. They released a study in *Human Movement Science* with a title that is fairly easy to understand: "Exploring how arm movement moderates the effect of task difficulty on balance performance in young and older adults".

The study invites people to marvel at the countless subtle ways by which upstanding humans manage to live upright lives: "we were primarily interested in changes in high frequency sway associated with ankle stiffening strategies".

Punching up data

While brain scientists elsewhere study the accumulated effects of a lifetime of whacks to the head, a quartet have been watching how people respond to the sight of a fist fast approaching their face. An account of their action-adventure experiment jabs out from the midsection of the journal *Human Movement Science*.

The research team is a foursome based at Loughborough University in the UK, Paderborn University in Germany and the Institute for Human and Machine Cognition and the University of Utah in the US. Their stated goal: to understand how the delay between a feigned punch and a real punch affects the reaction of the person being targeted. But given the limits of using computer technology as a substitute for an actual, sweating, flesh-and-blood-and-boxing-gloves punch, this involved a feigned simulated punch and a real simulated punch.

Volunteers watched a computer screen display animation images of two bright red boxing gloves, one to the left, one to the right. Sometimes one glove feigned a punch: "The feint was simulated by a glove briefly enlarging by 25% then returning to normal size." The actual simulated punch "enlarged by 50% and moved closer to the center, creating a rapid looming effect of a punch moving toward the participant's head". The reported discovery from this is: "if the timing of the feint is right", even trained athletes will suffer a pounding.

The researchers express a hope of doing experiments that use "a virtual reality headset that could better simulate a punch coming directly at the participant". They mention no plans to repeat the experiment using nonvirtual reality and are blunt about a basic problem that may be independent of any technology: "A limitation of this study was that it was difficult to find experts willing to participate." ▮

Marc Abrahams

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